FEASIBILITY STUDY REPORT

FOR THE

FORMER MAGNA METALS SITE

(NYSDEC Site No. 360003)

TOWN OF CORTLANDT

WESTCHESTER COUNTY, NEW YORK

DECEMBER 2009

PREPARED BY:

TETRA TECH ENGINEERING CORPORATION PC

1000 The American Road
Morris Plains, New Jersey 07950

CERTIFICATION STATEMENT

To the best of my knowledge, I certify that this Feasibility Study was prepared in accordance with all applicable statutes and regulations and in substantial conformance with New York State Department of Environmental Conservation guidance and that all activities were performed in full accordance with the New York State Department of Environmental Conservation-approved Work Plan and any New York State Department of Environmental Conservation modifications.

TETRA TECH ENGINEERING CORPORATION PC

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Type/Printed Name Signature

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Date

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EXECUTIVE SUMMARY

This report presents the results of a Feasibility Study (FS) performed by Tetra Tech EC, Inc. (TtEC) on behalf of ISC Properties (ISCP) for the Magna Metals Site (the Site) in the Town of Cortlandt, New York. The FS satisfies requirements specified in the 1996 Order-On-Consent between ISCP and the NYSDEC. This report was completed in substantial conformance with the New York State Department of Environmental Conservation (NYSDEC) "Draft DER-10 Technical Guidance for Site Investigation and Remediation" (2002).

The purpose of this FS is to identify and evaluate remedial alternatives to address contaminated on-site soil, groundwater, soil vapor, and off-site sediments. The FS process includes:

- Establishment of Remedial Action Objectives (RAOs);
- Identification of General Response Actions (GRAs) to address the RAOs;
- Identification and screening of technologies applicable to each GRA;
- Selection of process options for retained technologies;
- Combination of selected process options to form remedial alternatives;
- Detailed evaluation of remedial alternatives;
- Proposal of the remedial alternative; and
- Documentation of the FS process in this report.

The Magna Metals Site is located in the Town of Cortlandt, Westchester County, New York, near the intersection of Furnace Dock Road and Maple Avenue. Nearby towns include Peekskill and Croton-on-Hudson. The Site is part of a larger commercial property owned by Baker Properties, who acquired the property from ISCP in 1982, and has leased it to various commercial tenants. The identity of these commercial tenants and their use of the property have varied over time. Residential areas are located around the facility. A wetland area, stream, and pond are located near the Site.

Extensive remedial investigation (RI) activities have been performed at the former Magna Metals Site. In April 2009, NYSDEC determined the RI (TtEC, 2007) to be final.

Soil Investigation Summary

The strata underlying the Site are as follows in sequence from upper to lower:

1. Sandy to silty sand overburden unit (various depths across site, ranging from 2 to 18 feet in thickness).

2. Bedrock-Hornblende granite, hard rock with limited permeability.

Inorganic contaminants (i.e., metals) were found at elevated levels in subsurface soil at the Site; the highest concentrations of these compounds were detected in the vicinity of the leach pits and septic tanks near the former Magna Metals building. Elevated levels of inorganics in subsurface soil present a future potential for exposures based on exceedances of NYSDEC SCOs for Protection of Human Health. There are no current exposure routes that could impact human health or the environment due to subsurface soil existing on-site.

Groundwater Investigation Summary

Overburden groundwater exists in the form of a very shallow water-bearing unit of limited hydraulic significance (i.e., typically less than five feet in thickness). Periodically, monitoring wells are dry at the site, especially during periods of reduced precipitation. When overburden groundwater is present, the observed flow direction is to the west toward the unnamed tributary, the wetland area, and the confluence of the unnamed tributary and Furnace Brook.

Volatile organic compounds were detected at elevated levels in groundwater, with the highest concentrations of these compounds detected in the vicinity of the source areas (leach pits and septic tanks) near the Former Magna Metals building. Soil vapors were detected beneath the Polymedco building slab. Elevated levels may present a potential for future exposure for groundwater ingestion or contact based on exceedances of Class GA groundwater standards. Sub slab vapors may present a future inhalation exposure. Groundwater is not currently used at the Site or in the nearby vicinity based on County records.

Sediment Investigation Summary

A Habitat Based Assessment was performed to assess the impacts of elevated levels of inorganics and PAHs in sediments of the unnamed tributary, Furnace Brook, the unnamed pond, and the wetlands. The results of the Habitat Based Assessment determined nickel and copper as potential contaminants of concern for sediments associated with each area (i.e., Furnace Brook, the unnamed tributary, the unnamed pond, and the wetlands). Elevated levels may cause exposures to ecological receptors (based on NYSDEC SCO for Protection of Ecological Receptors standard).

Surface Water Investigation Summary

The Habitat Based Assessment identified elevated levels of inorganics in the unnamed tributary and the wetlands east of Furnace Brook. Due to location, frequency, and reappearance of inorganics in other media (*e.g.*, sediments) exceeding NYSDEC Criteria, remedial goals for surface water were not developed; the remediation of sediments will mitigate the surface water contamination.

Soil Vapor Investigation Summary

Three soil vapor sampling events were performed during the 2007, 2008, and 2009 heating seasons. Sampling included both sub-slab soil vapor and ambient indoor air. The highest sub-slab VOC concentrations were detected beneath the Polymedco office area, and to a much lesser extent, Motion Labs. TCE was the primary contaminant detected in sub-slab samples, and to a lesser extent, PCE, TCA, DCE, and toluene. TCE (the primary sub-slab soil vapor contaminant) was detected at concentrations below the NYSDOH Soil Vapor Intrusion Guidance Values for Indoor Air samples during all 3 sampling events. Minor detections in indoor air of other contaminants such as toluene and n-heptane were noted during the 3 sampling events. These contaminants are more likely to be associated with VOC sources within the buildings rather than VOC migration through the building sub-slab. Due to elevated concentrations of VOCs in sub-slab soil vapor, this Feasibility Study addresses their mitigation.

Remedial Action Objectives

The RAOs, based on NYSDEC DER-10, are as follows for each impacted media.

Soil

- Prevent ingestion/direct contact with contaminated soil
- Prevent migration of contaminants that would result in groundwater or surface water contamination
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain
- Remove the source of soil contamination, to the extent practicable

Groundwater

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater
- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable
- Prevent the discharge of contaminants to surface water
- Remove the source of groundwater contamination

Sediments

- Prevent direct contact with contaminated sediments
- Prevent surface water contamination which may result in fish advisories
- Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of ambient water quality criteria
- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain
- Remove the source of sediment contamination

Development of Alternatives

Following development of RAOs, identification of General Response Actions (GRAs) and screening of remedial technologies and process options, the following remedial alternatives were developed for detailed evaluation:

Soil Alternatives

- S-1: No Action
- S-2: Limited Action
- S-3: Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Restricted Use SCOs and Building Demolition

- S-4: Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Unrestricted Use SCOs and Building Demolition

Groundwater Alternatives

- GW-1: No Action
- GW-2: Groundwater Monitoring and Sub-Slab Vapor Mitigation
- GW-3: *In Situ* Treatment and Sub-Slab Vapor Mitigation
- GW-4: Limited Permanganate Treatment, Groundwater Monitoring, and Sub Slab Vapor Mitigation

Sediment Alternatives

- SD-1: No Action
- SD-2: Limited Action
- SD-3: Removal of Metals-Impacted Sediments
  - SD-3A: Off-Site Removal of Metals – Impacted Sediments above Habitat Assessment Based PRGs
  - SD-3B: Off-Site Removal of Metals – Impacted Sediments above Pre-Release Conditions
  - SD-3C: Off-Site Removal of Metals – Impacted Sediments above NYSDEC LELs

Evaluation of Alternatives

The media-specific remedial alternatives identified above were first evaluated individually, and then on a comparative basis using the following seven evaluation criteria:

1. Compliance with Standards, Criteria and Guidance (SCGs);
2. Overall Protection of Human Health and the Environment;
3. Short-Term Impact and Effectiveness;
4. Long-Term Effectiveness and Permanence;
5. Reduction of Toxicity, Mobility, and/or Volume;
6. Implementability; and
7. Cost.

Comparative Analysis of Soil Alternatives

Compliance with SCGs

Alternatives S-3 would achieve chemical-specific Restricted Use SCGs and S-4 would achieve Unrestricted Use SCGs for COCs by removal of soil exhibiting concentrations in excess of NYSDEC SCOs from the Site. The value added benefit of alternatives S-3 and S-4 is that impacted groundwater is remediated in areas of soil removal. Alternatives S-1 and S-2 do not remove contamination from the Site.

Overall Protection of Human Health and the Environment

Alternatives S-3 and S-4 are the most protective of health and the environment, since they remove material above NYSDEC SCOs from the Site and significantly reduce or eliminate exposure to COCs in soil. Alternative S-3 provides protection through removal of soil exhibiting concentrations above Restricted Use SCOs and through implementation of Institutional Controls, while Alternative S-4 provides protection through removal of soil exhibiting concentrations in excess of Unrestricted Use SCOs. Alternative S-2 mitigates exposure, but does not provide any removal or treatment that significantly reduces migration of contaminants or expedites the cleanup of the Site to regulatory standards. Alternative S-1 is the least protective, since it does not remove or treat contaminants nor mitigate the potential for exposure.

Short-Term Impact and Effectiveness

Alternatives S-1 and S-2 would have the lowest short-term impact. Alternatives S-3 and S-4 would produce disturbance of site contaminants as a result of construction activities. Alternatives S-3 and S-4 would have higher short-term impacts since any excavated or removed materials would need to be transported through off-site areas for off-site disposal. These impacts would be minimized through proper construction and transportation procedures and engineering controls.

Long-Term Effectiveness and Permanence

Alternatives S-3 is effective at contaminant reduction and reducing potential future exposure. Source materials would be removed and contaminated soil would be removed. Based on the known extent of COCs in excess of NYSDEC SCOs, Alternative S-3 achieves a similar reduction of COCs as Alternative S-4. Alternative S-2 is less effective, since all existing contamination, including sources of contamination, would remain on-site. Alternative S-1 would not be effective, since it would not reduce potential exposures. Long-term monitoring would be required.

Reduction of Mobility, Toxicity, and/ or Volume

Alternatives S-3 and S-4 offer significant reductions in mobility and volume of contaminated soil, since soil excavation occurs in a large area. Excluding contingency soil removals, alternatives S-3 and S-4 would remove approximately 7,000 and 7,800 CY of soil, respectively. Alternatives S-2 and S-1 offer no reduction in mobility, toxicity, or volume since no active remediation would be performed.

Implementability

Alternative S-1 is the easiest to implement, since no remedial activities are employed in this alternative. Alternative S-2 is also easy to implement, involving only institutional controls. Alternatives S-3 and S-4 would be more difficult to implement, as they involve building demolition and subsurface soil removal and installation of shoring and/or bracing.

Services, equipment, and materials are available for all alternatives. Alternatives S-1 and S-2 require no materials and limited services. Alternatives S-3 and S-4 require building demolition, excavation services, and backfill materials. Some on-site soil may be suitable for reuse to offset the quantity.

All of the alternatives evaluated are administratively feasible. Alternatives S-1 and S-2 would be the easiest to implement (short-term) since no remedial activity would be performed. The remaining alternatives involve construction activities and associated administrative activities. Alternatives S-3 and S-4 would have some additional coordination requirements for demolition and off-site transportation, which the other alternatives would not entail. Long-term institutional management (*e.g.*, monitoring, reporting, public coordination) would be associated with all of the alternatives except for S-4.

Cost

Alternative S-1 has no capital costs and no O&M costs. Alternative S-2 has the next lowest capital cost and minimal O&M costs for periodic reviews. Alternative S-3 has the second highest capital costs, and minimal O&M costs for reviews. Alternative S-4 has the highest capital costs and no O&M costs. Alternative S-3 will result in comparable level of exposure reduction as S-4, but at a lower cost. Overall, the ranking of the alternatives based on net present value from lowest to highest is: S-1, S-2, S-3, S-4.

Comparative Analysis of Groundwater Alternatives

Compliance with SCGs

Alternatives GW-1, GW-2, GW-3, and GW-4 would be performed in accordance with action- and location-specific SCGs. Alternative GW-1 would not trigger action or location specific SCGs. Alternatives GW-1 and GW-2 may eventually achieve chemical-specific SCGs for VOCs over an extended period of time by natural processes. Implementation of Alternative S-3 or S-4 achieves SCGs of groundwater in the overburden within the alternative's excavation boundaries. Alternative GW-3 could achieve SCGs without the implementation of active soil remedial activities. Alternative GW-4 is designed to be implemented in conjunction with Soil Alternatives S-3 or S-4.

Overall Protection of Human Health and the Environment

Alternative GW-1 is the least protective, as it is a No Action alternative. Alternative GW-2 provides monitoring, institutional controls, and a sub-slab vapor mitigation system. Alternative GW-2 also involves hydraulic modeling and the construction of an expanded monitoring well network following soil removal. Monitoring of contaminants in groundwater would be implemented and groundwater use restrictions would be maintained. Alternative GW-3 involves active treatment of contaminated groundwater and would be more effective than GW-2. Alternative GW-4 involves a one-time limited application of permanganate to the top of bedrock, in conjunction with the soil excavation activities, to provide enhanced restoration of groundwater.

Short-Term Impact and Effectiveness

Alternative GW-1 would have the lowest short-term impact. The short-term impact of Alternatives GW-2 and GW-4 would be slightly greater, since on-site construction of monitoring wells and a sub slab vapor system will be required. The short-term impact of Alternative GW-3 would include more intrusive activities at the Site.

Long-Term Effectiveness and Permanence

Alternatives GW-1, GW-2, GW-3, and GW-4 would all require an extended period of time for groundwater to reach acceptable levels. GW-1 and GW-2 require the greatest amount of time, while GW-3 and GW-4 would require less time. Monitoring would provide additional assurance that there aren't off-site exposures. Alternative GW-3 would achieve protection of health over a shorter time period than GW-2 because it involves actively treating the contamination in groundwater. Alternative GW-4 would provide additional protection of groundwater beyond GW-2 because it involves limited application of chemical reagents.

Reduction of Mobility, Toxicity, and/or Volume

Alternative GW-1 offers no reduction in mobility, toxicity, or volume, since no active remediation would be performed. Alternative GW-2 offers no reduction by itself. However, significant reduction can be achieved in GW-1, GW-2, and GW-4 by implementation of soil Alternatives S-3 or S-4. Alternative GW-3 would provide reduction of contaminant mobility, toxicity, and/or volume via active treatment.

Implementability

All of the alternatives evaluated are technically feasible. Alternative GW-1 is easiest to implement. Alternative GW-2 is somewhat more difficult to implement, requiring hydraulic modeling to determine locations of monitoring wells and confirmatory sampling. Alternative GW-3 would be the most difficult to implement because it involves active remediation. Alternative GW-4 is similar in difficulty to GW-2.

Alternative GW-1 requires no services, equipment, or materials. Services, equipment and materials are readily available for Alternatives GW-2 and GW-3. Alternative GW-2 requires consulting services for monitoring and data evaluation, construction services for monitoring network installation, and construction of a soil vapor system and O&M of the system, all of which are readily available. Alternative GW-3 would require consulting services and services for treatment implementation as well as O&M. Treatment services and equipment for this alternative are available. Alternative GW-4 would require consulting services and services for treatment implementation as well as monitoring services.

Cost

Alternative GW-1 has no capital costs and no O&M costs. Alternative GW-2 has higher capital and O&M costs for implementation of monitoring activities, installation of a sub slab vapor system, and subsequent O&M. Alternative GW-3 has the highest capital costs. Sub-slab vapor system will have O&M costs in GW-2 ,GW-3, and GW-4. Alternative GW-4 has lower costs than GW-3.

Comparative Analysis of Sediment Alternatives

Compliance with SCGs

Alternatives SD-3A, SD-3B, and SD-3C remove contaminated sediments from the Site to achieve cleanup objectives. Alternatives SD-1 and SD-2 do not remove contaminated materials from the Site.

Overall Protection of Human Health and the Environment

Alternative SD-3C is the most protective of health and the environment because it would remove contaminated materials to NYSDEC LELs. Alternative SD-3B would re-establish sediment conditions similar to background (pre-release). Alternative SD-3A provides protection of resources by removing contaminated materials to habitat assessment-based PRGs. Alternative SD-2 prevents exposure through use restrictions, but does not provide any removal or containment that significantly reduces contaminant migration and/or ecological exposure. Alternative SD-1 is the least protective, since it does not remove or treat contaminants nor reduce the risk of exposure.

Short-Term Impact and Effectiveness

Alternatives SD-1 and SD-2 would have the lowest short-term impact. There would be no potential exposures to workers or the public during implementation of these alternatives, since no active remediation would be performed. Alternative SD-3A would have a high short-term impact because it involves excavation of contaminated sediment. Alternatives SD-3B and -3C would have the greatest short-term impacts, since they require extensive excavations of contaminated material. Alternative SD-3A, -3B, -3C could potentially increase risk of exposure to workers and the public. Off-site disposal is also required for Alternatives SD-3A, -3B, -3C. These impacts would be minimized through proper construction and transportation procedures and engineering controls.

Long-Term Effectiveness and Permanence

Alternatives SD-3B and -3C are the most effective at reducing potential exposures to health and the environment. Alternative SD-3A is effective at reducing habitat assessment-based risks to ecological resources. Implementation of Institutional Controls in Alternative SD-2 is less effective since existing contamination, including sources of contamination, would remain. Alternative SD-1 would not be effective, since it would not reduce potential health or ecological risks. Long-term monitoring would be required.

Reduction of Mobility, Toxicity, and/ or Volume

Alternatives SD-3B and -3C offer the most significant reduction in mobility and volume of contaminated soil, since sediments with contaminated material exceeding the most stringent remedial goals or criteria would be removed. Alternative SD-3A offers a significant reduction in mobility and volume. Alternatives SD-1 and SD-2 offer no reduction in mobility, toxicity, or volume.

Implementability

All of the sediment alternatives evaluated are technically feasible. However, SD-3B and SD-3C are the most challenging. Alternative SD-1 is the easiest to implement, since no remedial activities are employed in this alternative. Alternative SD-2 may be easy to implement, involving only institutional controls, however, the sediments are off-site and are on private property, which may make use restrictions difficult to implement. Alternatives SD-3A, -3B and -3C would be difficult to implement, as they involve removal of sediments in areas of surface water and wetlands. Control of water and stream flow would be required during implementation of SD-3A, -3B, and -3C. SD-3B and -3C are more difficult to implement because of the acreage involved, remoteness of some locations, and extensive mature wooded wetland system.

Services, equipment, and materials are available for all alternatives. Alternative SD-1 requires no materials or services. Alternative SD-2 requires limited services. Alternatives SD-3A, -3B and -3C require excavation, re-routing of streams and/or dewatering as well as restoration with appropriate material. The quantities of appropriate backfill are substantial; the quantity of backfill material under Alternatives SD-3B and -3C are the largest.

All of the alternatives evaluated are administratively feasible. Alternatives SD-1 and SD-2 would be the easiest to implement (short-term) since no or very limited activity would be performed. The remaining alternatives involve construction activities and associated administrative activities (*e.g.*, permitting, public participation and coordination, etc.). Alternative SD-3A, -3B, and -3C would have some additional coordination requirements for off-site transportation, which Alternatives SD-1 and SD-2 would not entail. Alternatives SD-3B and -3C may be very difficult to implement due to the property access issues, disturbances to third party property, and restoration requirements. Long-term institutional management (*e.g.*, monitoring, reporting, public coordination) would be associated with all of the alternatives except SD-1. In addition, off-site private property access will be required to implement Alternatives SD-3A, -3B and -3C.

Cost

Alternative SD-1 has no capital costs and no O&M costs. Alternative SD-2 has the next lowest capital and O&M costs for implementation of institutional controls. Removal alternatives have the highest capital and O&M costs (ranging in cost based on standards and criteria). Overall, the ranking of the alternatives based on net present value (capital and O&M) from lowest to highest is: SD-1, SD-2, SD-3A, SD-3B, and SD-3C.

Proposed Plan for Site Remediation

The proposed plan for the site remediation incorporates Alternatives S-3, GW-4, and SD-3A. Implementation of Alternative S-3 will remove COCs to meet chemical-specific SCGs. An added benefit of S-3 is that the impacted groundwater is also remediated via removal of overburden soils in excavation areas. Because the most significant groundwater impacted areas are addressed during S-3, the recommendation of Alternative GW-4 can be made and any potential future risk of exposure to groundwater can be controlled by institutional controls that prevent the installation of wells or usage of groundwater for potable supply at the Site. In addition, permanganate would be applied to the top of the bedrock surface and over time would enter any existing bedrock fractures to treat groundwater. Groundwater would be monitored by a monitoring well system subject to periodic reviews. Operation of the sub slab vapor mitigation system will also provide positive benefit. Implementation of Alternative SD-3A will remove contaminated sediments which will mitigate potential current and future risks.

The overall net present value based on a 30-year period of performance for implementation of the selected remedy (i.e., S-3, GW-4, and SD-3A) is $6,621,000.

1.0 INTRODUCTION

1.1 Purpose of the Report

This report presents the results of the Feasibility Study (FS) prepared for ISC Properties (ISCP) for the Former Magna Metals Site (the Site) in Cortlandt, New York. The FS is based on the Remedial Investigation (RI) Report which was approved by NYSDEC on April 3, 2009.

The purpose of the FS is to identify and evaluate media-specific remedial alternatives for contaminated soil (including soil vapor) sediments, and groundwater at the Site.

The FS satisfies requirements specified in the 1996 Order-On-Consent between ISCP and the NYSDEC. This report was completed in compliance with the New York State Department of Environmental Conservation (NYSDEC) "Draft DER-10 Technical Guidance for Site Investigation and Remediation" (2002).

The following additional guidance and criteria documents were considered in the development of this FS: the U.S. Environmental Protection Agency (USEPA) National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USEPA, 1994), the USEPA Interim Final guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (USEPA, 1988), the New York State Department of Environmental Conservation (NYSDEC) guidance document entitled "Guidelines for Remedial Investigation/Feasibility Studies" (NYSDEC, 1989), and the NYSDEC guidance entitled "Selection Of Remedial Actions At Inactive Hazardous Waste Sites" (NYSDEC, 1990).

1.2 Organization of the Report

This FS Report consists of seven sections whose contents are set forth below:

Section 2.0 Remedial Action Objectives – This section provides the applicable chemical-specific, action-specific, and location-specific standards, criteria and guidance (SCGs), the remedial action objectives (RAOs), and the general response actions (GRAs).

Section 3.0 Identification and Screening of Technologies and Selection of Process Options – This section describes the methodology and the results of the technology identification and screening, selection of process options, and development of alternatives that was performed as part of the FS.

Section 4.0 Detailed Analysis of Remedial Alternatives – This section provides a description of the seven criteria that were used for analysis of the remedial alternatives, and provides the detailed analysis of soil, sediment, and groundwater alternatives.

Section 5.0 Comparative Analysis – This section provides the comparative analysis of the soil, sediment and groundwater alternatives, using the seven criteria that were utilized for the Section 4.0 Detailed Analysis.

Section 6.0 Proposed Remedial Alternatives – This section provides the results of the evaluation process and identifies the proposed remedy for the Site.

Section 7.0 References – This section cites the references that were relied upon for information and guidance during the performance of the FS and preperation of this FS Report.

2.0 REMEDIAL ACTION OBJECTIVES

This section discusses the development of Remedial Action Objectives (RAOs) based on Standards, Criteria, and Guidance (SCGs). General Response Actions to address the RAOs are then identified.

2.1 Standards, Criteria, and Guidance (SCGs)

The Magna Metals Site is categorized as a Class II Inactive Hazardous Waste site by the NYSDEC. Activities at the Site are being performed under an Order on Consent. In accordance with 6 NYCRR 375-1, NYSDEC-issued permits are not required for environmental remediation activities conducted at this Site. Rather, the activities are evaluated and implemented based on the substantive elements of the applicable and relevant and appropriate state environmental laws and regulations. Federal applicable, relevant and appropriate requirements (ARARs) must be complied with fully, including the requirements to obtain permits if necessary. These federal and state environmental laws and regulations and other guidance To Be Considered (TBCs) are collectively referred to as SCGs.

The SCGs that may guide the remedial activities at the site are addressed in this section. This includes both New York State SCGs, as well as federal standards that are more stringent than State SCGs. New York State SCGs are standards or requirements that implement the New York State Environmental Conservation Law. Remedial actions conducted in New York State are required to attain SCGs to the extent practicable as per NYSDEC Subpart 375: Environmental Remediation Programs (December 2006).

SCGs are categorized as chemical-, action, or location-specific:

- Chemical-specific SCGs set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants or contaminants.
- Action-specific SCGs set controls or restrictions on particular kinds of activities that may be selected to accomplish a remedy. These SCGs may specify particular performance levels, actions or technologies to be used to manage hazardous substances, pollutants or contaminants.
- Location-specific SCGs set restrictions on activities within specific locations, such as wetlands and floodplains, and depend on the characteristics of a site and its immediate environs.

2.1.1 Chemical-Specific SCGs

Chemical-specific SCGs are health or risk-based concentrations for specific hazardous substances, pollutants, or contaminants in various environmental media. Chemical-specific SCGs include remediation goals for chemicals of concern (COCs) in designated media (i.e., soil, sediments, and groundwater). Statutes, regulations, and guidelines to be used in the identification of chemical-specific SCGs are listed in Table 2-1.

TABLE 2-1 (Sheet 1 of 2)
CHEMICAL-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
STATE				
Inactive Hazardous Waste Sites	Program for designating and managing inactive hazardous waste sites	Article 27, Title 13	Establishes general cleanup goals for environmental media to levels that will eliminate a significant threat to the environment. This allows NYSDEC to designate inactive hazardous waste disposal sites.	Sites are listed based on evidence of a significant threat posed by hazardous waste disposed of at the site. A significant adverse impact on the environment and/or a significantly increased risk to human health would constitute a significant threat. The Magna Metals site is classified as an Inactive Hazardous Waste Site.
Soil Cleanup Goals	NYSDEC Soil Cleanup Objectives	NYSDEC Subpart 375	Establishes soil cleanup objectives based on commercial land use and protection of groundwater quality	Specified clean-up goals may be referenced in determining site specific soil treatment levels.
Ecological Risk Assessments	Process for Designing and Conducting Ecological Risk Assessments, June 1997	EPA 540-R-97-006	Guidance document developed by USEPA for conducting ecological risk assessments.	Guidance to be considered for identifying ecological exposure pathways that remediation of sediments may address.

TABLE 2-1 (Sheet 2 of 2)
CHEMICAL-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
STATE				
Sediment Quality Screening	Guidelines for Deriving Site-Specific Sediment Quality Criteria for the Protection of Benthic Organisms, 1993	EPA 822-R-93-017	Guidance document developed by USEPA for developing sediment quality criteria for organic chemicals that are reflective of local conditions.	Guidance to be referenced in establishing sediment quality standards.
Sediment Cleanup Goals	NYSDEC Technical Guidance for Screening Contaminated Sediments	NYSDEC Technical Guidance for Screening Contaminated Sediments	Screening Criteria for purposes of identifying areas of sediment contamination and developing a preliminary assessment of risk to human health and the environment.	Guidance to be referenced in establishing sediment quality standards specific to the remediation of the streams and pond.
Surface Water Cleanup Goals	NYSDEC Ambient Water Quality Standards and Guidance Values – Class GA Standards	TOGS	Establishes toxicity based surface water quality criteria for protection of aquatic organisms and human health.	Ambient water quality criteria may be referenced in establishing surface water quality standards specific to the remediation of the streams and pond.
Groundwater Cleanup Goals	Groundwater and Surface Water Quality Standards	6 NYCRR 703	Establishes groundwater quality and surface water quality standards and provides maximum concentrations for specific parameters.	Contamination in excess of groundwater quality standards and surface water quality standards may require corrective actions.

2.1.2 Action-Specific SCGs

Action-specific SCGs are technology or activity-based requirements or limitations. These SCGs are triggered by, and apply to, the implementation of particular remedial activities. Federal and state statutes, regulations, and guidelines used to identify action-specific SCGs for the site are listed in Table 2-2.

Of primary consideration are the Resource Conservation and Recovery Act (RCRA) hazardous waste management regulations (and the NYSDEC equivalents). The Land Disposal Restriction (LDRs) requirements of the RCRA regulations (40 CFR 268) apply to the placement of hazardous waste in land disposal units. The RCRA LDRs are potential SCGs for the excavation and disposal of impacted soils. Specifically, excavated soils that are characterized as hazardous waste must meet stringent treatment standards prior to final land disposal.

Pursuant to the Phase IV amendments to the LDR regulations, soils contaminated with hazardous wastes may be treated to meet LDRs or an alternate treatment standard. Under this Alternate Treatment Standards rule revision, hazardous waste constituents in soils can be reduced by 90 percent capped at 10 times the applicable LDR Universal Treatment Standard. Prior approval for use of Alternative Treatment Standards for hazardous waste soils is not required.

Other Action-Specific SCGs that may apply to the remedial activities at the site include the NYSDEC solid and hazardous waste handling, transportation and disposal regulations and ambient air quality standards and emission limitations.

2.1.3 Location-Specific SCGs

Location-specific SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Statutes, regulations, and guidelines used in the identification of location-specific SCGs are listed in Table 2-3.

2.2 Remedial Action Objectives

The RAOs for the site are developed based on the contaminants of concern, potential exposure routes, receptors, and acceptable concentrations for each exposure route in order to protect health and the environment.

2.2.1 Contaminants of Concern

A number of COCs were identified based on information obtained during the Remedial Investigation. COCs were identified for each environmental medium (soil, sediments, and groundwater), based on historical information, concentrations relative to NYSDEC Criteria,

TABLE 2-2 (Sheet 1 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
Generation, Management, and Treatment of Hazardous Waste	Resource Conservation and Recovery Act (RCRA) Subtitle C - Hazardous Waste Management	40 U S C Section 6901 et seq.		
	Identification and Listing of Hazardous Wastes	40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266	These regulations do not set clean-up standards, but would apply to the classification of all impacted soils and residual waste streams generated during remedial activities.
	Hazardous Waste Determinations	40 CFR Part 262.11	Generators must characterize their wastes to determine if the waste is hazardous by listing (40 CFR 261, Subpart D) by characteristic (40 CFR 261, Subpart C) or excluded from regulation (40 CFR 261.4)	Excavated soils may be classified as characteristic or listed hazardous wastes. By-products or residues from the treatment of contaminated soils, sediments, and groundwater must also be characterized.
	Manifesting	40 CFR 262, Subpart B	Generators must prepare a Hazardous Waste Manifest (EPA form 8700-22) for all off-site shipments of hazardous waste to disposal or treatment facilities	Will apply to all off-site shipments of RCRA/NYSDEC hazardous wastes.
	Recordkeeping	40 CFR 262.40	Generators must retain copies of all hazardous waste manifests used for off-site disposal	Generator must retain copies of waste manifests for a minimum period of three years after shipment date.

TABLE 2-2 (Sheet 2 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont'd)	Labeling and Marking	40 CFR 262, Subpart C	Species EPA marking, labeling and container requirements for off-site disposal of hazardous waste	Pre-transportation requirements for off-site shipments of hazardous wastes.
	Accumulation Limitations	40 CFR Part 262.34	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers, and containment buildings without having to obtain a RCRA hazardous waste permit.	Hazardous wastes may be stored for up to 90 days on-site without the need for a storage permit unless NYSDEC waives the 90-day limit as an administrative requirement.
	Standards for Owners/Operators of Hazardous Waste Treatment, Storage, Disposal (TSD) Facilities General Facility Standards	40 CFR Part 264/265 Subpart B	General requirements for owners/operators of TSD facilities including general waste analysis and compatibility, notices and inspection requirements, location and construction standards, and security	These subpart standards would be applicable to the on-site management of hazardous waste soils and sediments in tanks, containers or containment buildings.
	Closure and Post-Closure	Subpart G	Established closure and post-closure requirements for hazardous waste treatment and storage units	

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TABLE 2-2 (Sheet 3 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
	Container Management	Subpart I	Hazardous waste stored in containers must comply with management requirements, including types of containers used, waste compatibility and inspection requirements.	Applicable to storage and/or treatment of hazardous wastes in containers on-site.
	Tank Systems	Subpart J	Tank systems for the treatment or storage of hazardous wastes are to be designed and operated in a manner to prevent releases to the environment	Applicable for the tank treatment and/or storage of all site generated wastes classified as a hazardous waste.
	Containment Buildings	Subpart DD	Containment buildings must be designed, constructed, and operated to meet regulatory performance standards	Standards applicable to the construction of containment buildings used to treat and/or store hazardous waste. .
Capping of Hazardous Waste	RCRA Subtitle C	40 U S C Section 6901 et seq.		
	Standards for Capping Surface Impoundments Waste Piles Landfills	40 CFR Part 264/265 Subpart K Subpart L Subpart N	Regulations governing placement of caps or similar barriers over hazardous waste. Requirements for installation, permeability, maintenance of cover, elimination of free liquids or solidification, run-on/run-off damage control, and post-closure use of property	Requirements potentially applicable to the upland disposal of hazardous waste excavated material.
Capping of Non-Hazardous Waste	RCRA Subtitle D	42 U S C Section 6901 et seq.		
	Criteria for Classification of Solid Waste Disposal Facilities	40 CFR Part 257	Minimum criteria for siting, construction, operation, and closure of solid waste disposal facilities. Each State is to develop, permit, and enforce a solid waste management program based on USEPA requirements	Requirements potentially applicable to the on-site disposal of contaminated soils and the upland disposal of and associated residual waste streams.

TABLE 2-2 (Sheet 4 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
Water Quality Impacts	Clean Water Act	33 U S C Section 1251-1376		
	Ambient Water Quality Criteria Guidelines	40 CFR Part 131	Establishes toxicity-based surface water quality criteria for protection of aquatic organisms and human health.	Ambient water quality criteria would be potentially applicable in establishing cleanup standards and establishing discharge standards for treated groundwater.
	Wastewater Discharge Permits, Effluent Guidelines, Best Available Technology (BAT) and BMPPT	40 CFR Parts 122, 125, 401	Permit requirements for point source discharges to waters of the United States, establishes effluent standards and requirements for preventing toxic releases	Potentially applicable for remedial activities involving a direct wastewater discharge to nearby surface water and/or diversions/disruptions of the surface water flows of the streams and pond that would impact water quality.
Air Emissions from a Point Source	Clean Air Act (CAA)	40 U S C Section 7401-7642		
	National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for protection of public health	NAAQS may be applicable in evaluating whether there are air impacts at the site during remedial activities.
	New Source Review (NSR) and Prevention of Significant Deterioration (PSD) Requirements	40 CFR Part 52	New Sources or modifications which emit greater than the defined threshold for listed pollutants must perform ambient impact analysis and install controls which meet best available control technology (BACT)	These regulations are potentially applicable and would require a comparison of potential emissions from the remedial activity to the emission thresholds for NSR.
	National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61 40 CFR Part 63	Source-specific regulations which establish emissions standards for hazardous air pollutants (HAPs)	NESHAPs may be applicable if emissions from remediation activities exceed the thresholds for compliance.

TABLE 2-2 (Sheet 5 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
	New Source Performance Standards (NSPS)	40 CFR Part 6	Source-specific regulations which establish testing, control monitoring and reporting requirements for new emission sources	NSPS could be relevant and appropriate if steam-generating equipment, thermal desorption units, or other regulated new sources were to be used onsite.
Land Disposal of Hazardous Waste	RCRA Subtitle C	40 U S C Section 6901 et seq.		
	Land Disposal Restrictions (LDRs)	40 CFR Part 268	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous wastes must be treated to prior to land disposal. Phase IV rule revision establishes Alternate Treatment Standards for Soils containing hazardous wastes.	Wastes exhibiting a hazardous characteristic would need to be treated to meet UTS for all hazardous constituents present in the residuals prior to any upland disposal. Characteristically hazardous soils can be treated to meet the UTS standards or to meet the alternative treatment standards for RCRA hazardous soils.

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TABLE 2-2 (Sheet 6 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
STATE				
Generation, Management, and Treatment of Hazardous Waste	Siting of Industrial Hazardous Waste Facilities	6 NYCRR Part 361	Establishes procedures for selecting appropriate sites for hazardous waste facilities	These regulations are potentially applicable for remediation activities which would involve the construction of upland hazardous waste management facilities
	NYSDEC Division of Hazardous Substances Regulation Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376	These regulations do not set clean-up standards, but would apply during the on-site management of excavated hazardous waste soils and the upland management of and residual waste streams generated during remediation activities.
	New York State Hazardous Waste Management Facility Regulations	6 NYCRR Part 370.373.372	Establishes New York State's USEPA equivalent hazardous waste management program. Includes regulations for hazardous waste facility construction, operation, and closure, and standards for hazardous waste generation, manifesting, and transport	[See RCRA Hazardous Waste Management Regulations. 40 CFR Parts 263 and 264/265 under Federal SCGs listed in this table]

TABLE 2-2 (Sheet 7 of 7)
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
Capping of Non-Hazardous Waste	New York State Solid Waste Management Facility Regulations	6 NYCRR Part 360, 364	Establishes New York State's USEPA equivalent solid waste management program. Includes regulations governing construction, operation, and closure of solid waste disposal facilities	These regulations are potentially applicable to remediation activities involving the upland management and disposal of non-hazardous wastes.
Water Treatment Discharge	New York State Regulations on the State Pollution Discharge Elimination System (SPDES)	6 NYCRR Parts 750-758	State Pollution Discharge Elimination System (SPDES) Permitting Requirements	May be applicable to discharge of treated groundwater.
	New York State Water Classifications and Quality Standards	6 NYCRR Parts 701, 702, 704	Defines surface water classifications and ambient water quality standards that are the basis for establishing effluent limitations under the SPDES program.	Furnace Brook is classified as a Class C stream.
	NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in NYSDEC programs, including the SPDES permit program.	These standards and guidance values are applicable in establishing discharge limitations to surface waters.
Air Emissions	New York State Air Pollution Control Regulations	6 NYCRR Parts 120, 200-203, 207, 211, 211, 212, 219 Air Guide-1	Establishes emissions standards for new sources of air pollutants and specific contaminants.	Requirements would be applicable to remediation alternatives that result in emissions of air contaminants, including particulate matter.
	New York State Ambient Air Quality Standards	6 NYCRR Part 257	Establishes state ambient air quality standards and guidelines for protection of public health.	May be applicable in evaluating air impacts during remediation activities. Establishes short-term action limits for occupational exposure.

TABLE 2-3 (Sheet 1 of 1)
LOCATION-SPECIFIC SCGs

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
FEDERAL				
Floodplains	Executive Order 11988 - Floodplain Management	40 CFR 6, Subpart A; 40 CFR 6.302	Activities taking place within floodplains must be done to avoid adverse impacts and preserve beneficial values in floodplains.	Activities may occur within the floodplain of the Hudson River.
Wetlands/Waters of the U.S.	Dredge and Fill in Wetlands	33 CFR Parts 320-330/40 CFR Part 230	Dredge or fill material into wetlands must be evaluated based on specific criteria.	Would be applicable to remediation activities impacting jurisdictional wetlands.
	Executive Order 11990 - Protection of Wetlands	40 CFR Part 6 Subpart A	Activities taking place within wetlands must be done to avoid adverse impacts.	Would be applicable to remediation activities conducted in jurisdictional wetlands.
Historic/Cultural Resources	National Historic Preservation act	16 USC 470	Establishes requirements for the identification and preservation of historic and cultural resources	Would be applicable to the management of historic or archeological artifacts identified on the site.
Critical Habitat	Endangered Species Act and Fish and Wildlife Coordination Act	16 USC 661 and 16 U.S.C. 1531	Actions must be taken to conserve critical habitat in areas where there are endangered or threatened species.	Requirements would be applicable if endangered or threatened species are identified on or adjacent to the site.
Considering Wetlands at CERCLA Sites	Wetlands Protection at CERCLA sites	OSWER 9280.0-03	Guidance document to be used to evaluate impacts to wetlands at Superfund sites	Requirements should be considered when evaluating impacts to jurisdictional wetlands.
STATE				
Water Resources	Protection of Waters	6 NYCRR 608	Regulates removal or placement of fill materials within state waters.	Placement of fill materials and/or excavation of sediment within with pond and streams.
Floodplains	Floodplain Management Regulations	6 NYCRR Part 500	Establishes floodplain management requirements including limitations on projects, including placement of fill, which may result in an increase in flood levels or water surface elevations during a base flood discharge.	Remediation activities may occur within the floodplain of Furnace Brook.
Floodplain	TSD Facility Permitting Requirements	6 NYCRR Subpart 373-1	Facility must be designed and operated to avoid washout.	Requirements are potentially applicable to any upland treatment, storage or disposal of hazardous wastes within the floodplain of Furnace Brook.
Wetlands	Alteration of Freshwater Wetlands	6 NYCRR Subpart 663	Establishes requirements for activities taking place in freshwater wetlands, including dredging, draining, fill or placement of structures.	Would be applicable to work conducted in wetlands or greater than 12.4 acres or in adjacent areas.

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natural (background) levels and/or toxicological characteristics. The media-specific COCs are listed in Table 2-4.

Figures 2-1 through 2-3 depict COCs in soil and groundwater that exceed applicable regulatory benchmarks. Figures 2-4 through 2-8 depict conceptual illustrations of inorganic COCs in sediments, which form the basis of sediment remedial action alternatives, as they depict areas having contaminants that were detected above PRGs (preliminary remediation goals) and therefore, are areas considered for remedial actions.

2.2.2 PRGs

Preliminary remedial goals for soil are based on the NYSDEC Subpart 375 values for Protection of Groundwater, Protection of Ecological Resources, and Protection of Human Health. Protection of Human Health Commercial SCOs were considered for on-site soils, and Protection of Human Health Residential SCOs were considered for off-site soils. Table 2-5 summarizes the potential PRGs for soil.

PRGs for groundwater are based on the TOGS 1.1.1 Class GA Groundwater Criteria. Table 2-6 summarizes the potential SCG-based PRGs for groundwater.

Ecological PRGs for inorganics in sediments were based on the results of the Habitat Assessment in the Final RI Report. Site-specific Maximum No Observed Effect Concentration PRGs are listed in Table 2-7 for the two Habitat Assessment sediment areas developed during the RI where exceedances occurred (*i.e.*, Furnace Brook/Unnamed Pond and Unnamed tributary). Two additional remedial goals requested by NYSDEC (during finalization of the RI Report) for each inorganic contaminant of concern in sediments are also listed in Table 2-7. The additional NYSDEC required remedial goals are based on pre-release conditions (background sample results) and NYSDEC Lowest Effect Levels (LELs). The pre-release and LEL remedial goals have been applied to the same areas for which the Ecological PRGs were developed (*i.e.*, Furnace Brook/Unnamed Pond and Unnamed Tributary).

PRGs for organics in sediments were not developed for the Site since the organic COCs for sediment (primarily benzo(a)pyrene) were linked to sources unrelated to historical operations at the Site (*e.g.*, runoff from Furnace Dock Road).

Ecological PRGs for off-site surface soil locations SS-6 through SS-10 associated with sediment/wetland areas are also listed in Table 2-7. Surface soils in these locations will be included with the sediment remedial alternatives. The remaining off-site surface soil locations (SS-04 and SS-13 through 15) are considered background samples.

As discussed in the Final RI, surface water concentrations were compared to ecological screening criteria to determine if potential risks to aquatic life were present. Due to location, frequency, and reappearance in other media (*e.g.*, sediments) of COCs in surface water exceeding NYSDEC Criteria, PRGs for surface water were not developed. The remediation of sediments will facilitate recovery of surface water.

2.2.3 Remedial Action Objectives

In this section, RAOs for the Site are identified based on the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (last revised December 2002). The media-specific RAOs for the Site are listed below:

Soil

- Prevent ingestion/direct contact with contaminated soil
- Prevent migration of contaminants that would result in groundwater or surface water contamination
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain
- Remove the source of soil contamination, to the extent practicable

Groundwater

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater
- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable
- Prevent the discharge of contaminants to surface water
- Remove the source of groundwater contamination

Sediments

- Prevent direct contact with contaminated sediments
- Prevent surface water contamination which may result in fish advisories
- Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of ambient water quality criteria
- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain
- Remove the source of sediment contamination

TABLE 2-4
CHEMICAL CONTAMINANTS OF CONCERN BY MEDIA

SOIL	***GROUNDWATER***
<u>Inorganics</u> Arsenic Chromium Copper Cyanide Lead Mercury Nickel Selenium Zinc <u>Semivolatiles</u> Benzo(b)fluoranthene Benzo(a)pyrene	<u>Volatiles</u> PCE TCE cis-1,2-DCE <u>Inorganics</u> Arsenic Chromium Copper Cyanide Nickel Selenium

SURFACE WATER	***SEDIMENTS***
<u>Inorganics</u> Copper Zinc	<u>Inorganics</u> Nickel Copper Zinc <u>Semivolatiles</u> Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(d)fluoranthene Benzo(a)pyrene

TABLE 2-5

POTENTIAL SCG-BASED PRGs FOR SOIL

Site-Related Contaminant	SCO-Based PRGs Residential Use (mg/kg)	SCO-Based PRGs Commercial Use (mg/kg)	SCO-Based PRGs Protection of GW (mg/kg)	SCO-Based PRGs Protection of Ecological Resources (mg/kg)
Inorganics				
Copper	270	270	1,720	50
Cyanide	27	27	40	NC
Nickel	140	310	130	30
Arsenic	16	16	16	13
Chromium	36	1,500	NC	41
Selenium	36	1,500	4	3.9
Lead	400	1,000	450	63
Zinc	2,200	10,000	2,480	109
Mercury	0.81	2.8	0.73	0.18
Semivolatiles				
Benzo(b)fluoranthene	1	5.6	1.7	NC
Benzo(a)pyrene	1	1	22	2.6

Notes – Based on NYSDEC SCOs Subpart 375-6
NC – No criteria specified
Chromium criteria listed is for trivalent chromium

TABLE 2-6
POTENTIAL SCG-BASED PRGs FOR GROUNDWATER

Site-Related Contaminant	TOGS 1.1.1 Class GA-Based Groundwater SCG-Based PRGs (ug/L)
Inorganics	
Arsenic	25
Chromium	50
Copper	200
Nickel	100
Selenium	10
Cyanide	200
Volatiles	
Tetrachloroethene	5*
Trichloroethene	5*
cis-1,2-Dichloroethene	5*
* The principal organic contaminant standard for groundwater of 5 ug/L applies to this substance	

TABLE 2-7
POTENTIAL SCG-BASED PRGs FOR INORGANICS IN SEDIMENTS

FURNACE BROOK/UNNAMED POND				
Inorganic COCs	**Site Specific Maximum No Observed Effect Concentration* PRGs**		**NYSDEC Lowest Effect Level (LEL) PRGs**	**Background Concentration[2] PRGs**
	(mg/Kg)	**SEM/AVS[1]**	**(mg/Kg)**	**(mg/Kg)**
Nickel	200.0	<1.0	16.0	24.1
Copper	415.0	<1.0	16.0	13.7
Zinc	NA[3]	NA[3]	120	54.1
UNNAMED TRIBUTARY				
Inorganic COCs	**Site Specific Maximum No Observed Effect Concentration* PRGs**		**NYSDEC Lowest Effect Level (LEL) PRGs**	**Background Concentration[1] PRGs**
	(mg/Kg)	**SEM/AVS[1]**	**(mg/Kg)**	**(mg/Kg)**
Nickel	143.0	<1.0	16.0	24.1
Copper	107.0	<1.0	16.0	13.7
Zinc	NA[3]	NA[3]	120	54.1

*No observed impairment in survival or growth in *Hyalella azteca* and *Chironomus tentans* relative to the background location.

[1] Ratio of soluble extractable metals to acid volatile sulfide

[2] Average background concentration from five upgradient sediment samples (SD-27 through SD-31) used to determine preliminary remedial goals.

[3] Zinc was not identified as a contaminant of potential concern for the Furnace Brook/Unnamed Pond or the Unnamed Tributary areas during the RI; therefore, habitat assessment-based PRGs for zinc were not developed.

2.3 General Response Actions

To attain the RAOs developed for the site, the following GRAs for soil, groundwater, and sediments have been identified:

1. No Action
2. Limited Action
   a. Institutional Controls (*e.g.*, environmental easements)
   b. Engineering Controls (*e.g.*, access restrictions)
3. Containment
4. Treatment/Disposal
   a. *In situ* Treatment
   b. Removal/Treatment/Disposal

No Action involves no institutional controls, containment, or treatment, but would include reviews for periodic reevaluation of site conditions. Limited Action involves measures that restrict access to contaminated areas through physical and/or administrative measures, and typically include long-term monitoring.

Containment actions include technologies that involve little or no treatment, but provide protection of health and the environment by reducing mobility of contaminants and/or eliminating pathways of exposure.

Treatment/Disposal actions include technologies that act to reduce the volume, toxicity and/or mobility of contaminants. These technologies include *in situ* treatment or removal and *ex situ* treatment (e.g., physical, chemical, thermal, biological). Disposal actions include both on-site and off-site disposal technologies.

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LEGEND

MW-02 GROUNDWATER SAMPLE LOCATION

320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTES:

1. ALL UNITS IN UG/L.

2. D – FROM A DILUTED SAMPLE.

3. ONLY THE MOST RECENT SAMPLING ROUND FOR EACH PARAMETER IS SHOWN.

4. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, GEOPHYSICAL SURVEY AREA, AND MONITORING WELLS ARE BASED ON SURVEY DATA.

Constituent	New York Groundwater Quality Standard
Tetrachloroethene	5
Trichloroethene	5
cis-1,2-Dichloroethene	5
Arsenic	25
Chromium	50
Copper	200
Nickel	100
Selenium	10
Cyanide	200

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.

2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.

3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.

4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.

5. TOPOGRAPHIC LINES ARE APPROXIMATE.

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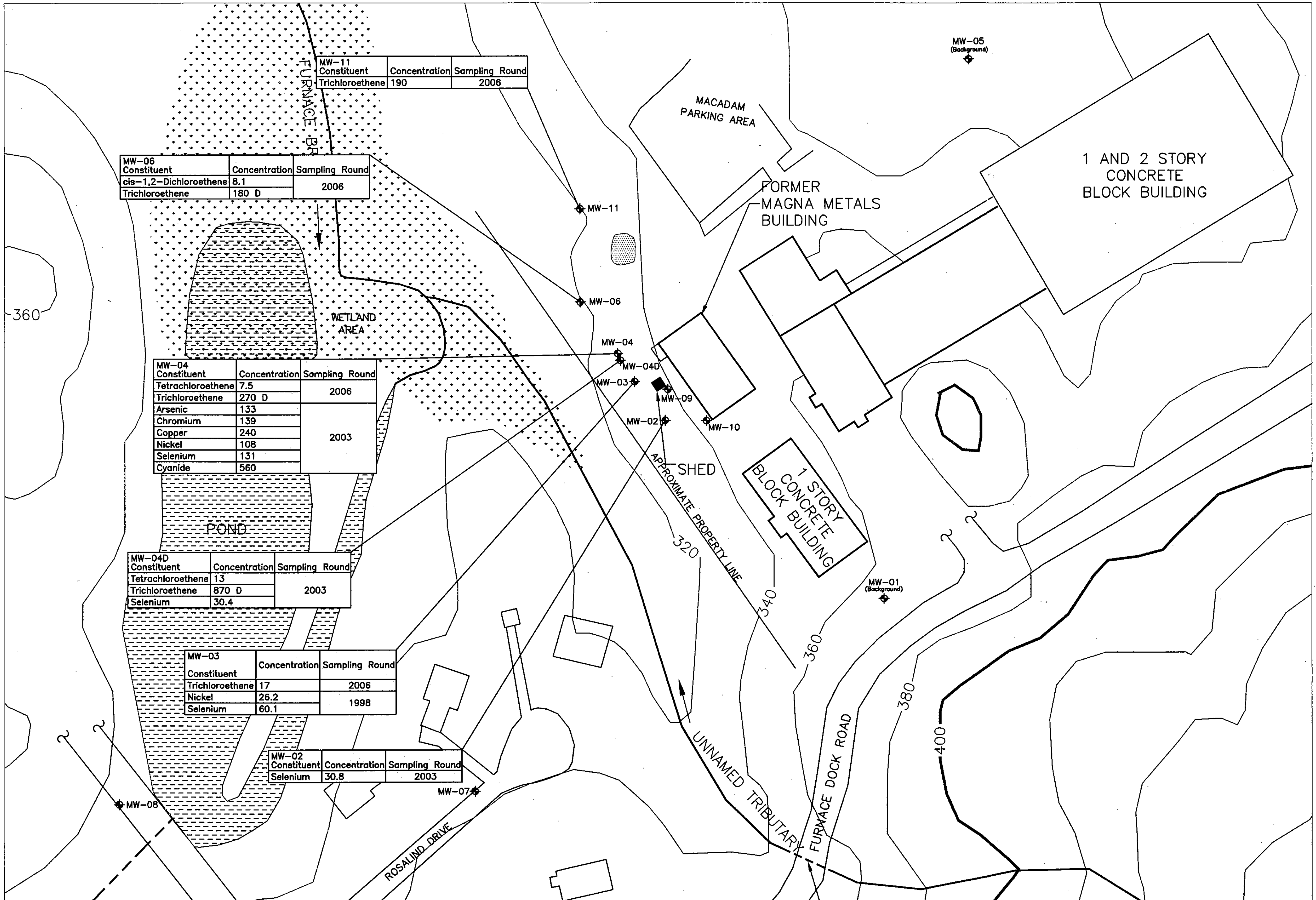

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TITLE:
Contaminants of Concern in Excess of Class GA Groundwater Quality Criteria
Magna Metals
Cortlandt, New York

DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
CHKD:	APPD:	FIGURE NO.: 2-3
DATE: 12/10/09	REV.: 0	

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 2-3 GW 121009.DWG

BCLP04185

LEGEND

SD-18 220 ◆ SEDIMENT SAMPLE LOCATION (FURNACE/POND) COPPER CONCENTRATION IN MG/KG

SD-10 60 ◆ SEDIMENT SAMPLE LOCATION (UNNAMED TRIB) COPPER CONCENTRATION IN MG/KG

320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTE: ONE COLOR REPRESENTS TWO DIFFERENT HABITAT ASSESSMENT-BASED CRITERIA FOR THE TWO SEPARATE AREAS FOR THE PURPOSES OF DEVELOPING REMEDIAL ALTERNATIVES.

FURNACE BROOK/UNNAMED POND SYSTEM NOTE:

1. THE HABITAT ASSESSMENT-BASED PRG FOR COPPER IS 415 MG/KG.

>415 MG/KG COPPER

UNNAMED TRIBUTARY SYSTEM NOTE:

1. THE HABITAT ASSESSMENT-BASED PRG FOR COPPER IS 107 MG/KG.

>107 MG/KG COPPER

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.

2. SD-27 THROUGH SD-31 ARE BACKGROUND SAMPLE LOCATIONS.

3. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.

4. THE EXTENT OF THE CONTAMINATED AREA IS APPROXIMATE.

5. SAMPLE LOCATIONS FOR SD-13 TO SD-26 ARE BASED ON GPS COORDINATES.

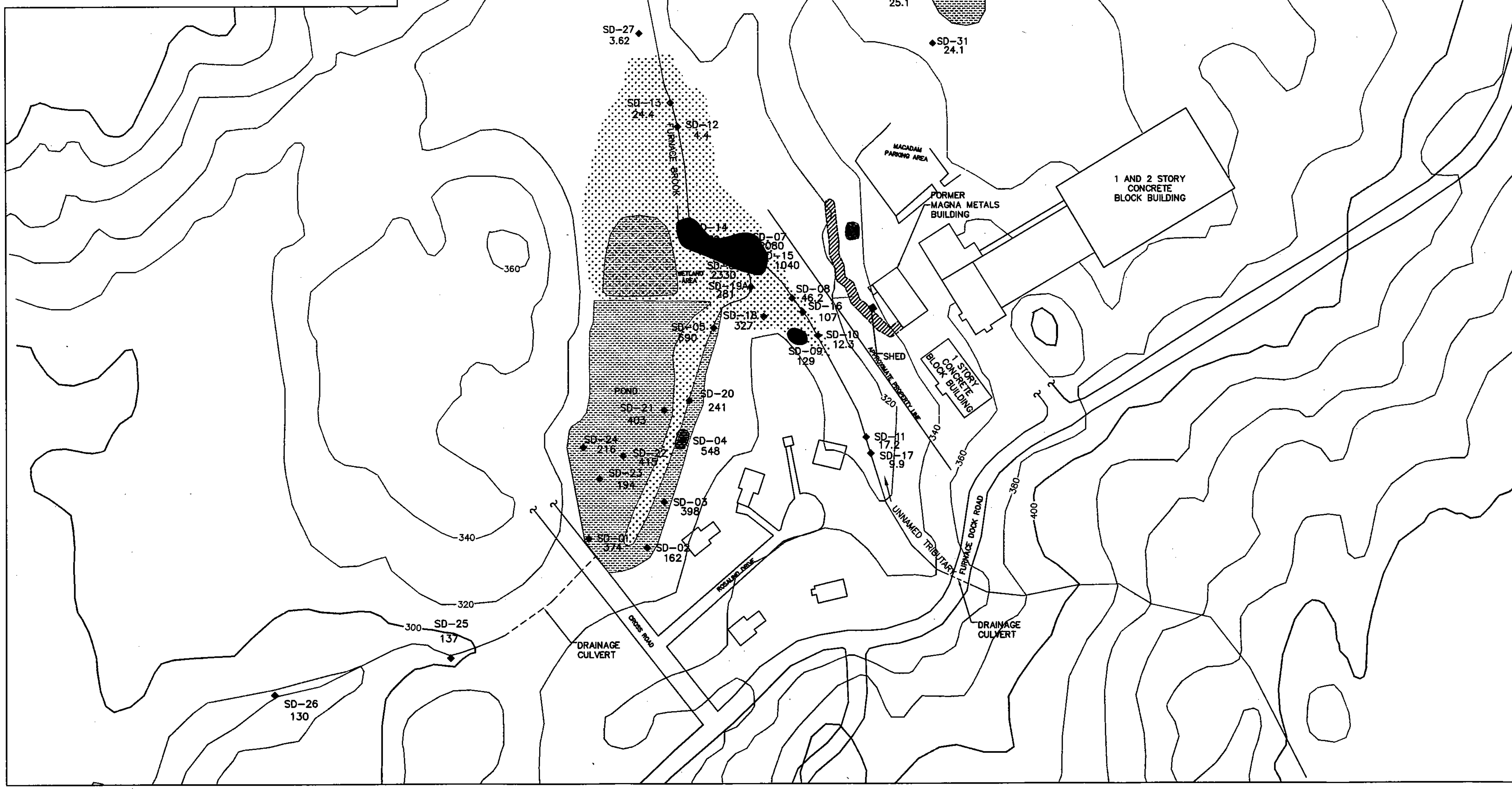
SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.

2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.

3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.

4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.

5. TOPOGRAPHIC LINES ARE APPROXIMATE.



TETRA TECH EC, INC.

TITLE: Copper in Off-Site Sediment Above Habitat Assessment-Based PRGs
Magna Metals
Cortlandt, New York

DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
CHKD:	APPD:	FIGURE NO.: 2-4
DATE: 12/10/09	REV.: 0	

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 2-4 COPPER IN OFF-SITE SED 121009.DWG

BCLP04186

LEGEND

SD-18 220 ◆ SEDIMENT SAMPLE LOCATION (FURNACE/POND) NICKEL CONCENTRATION IN MG/KG

SD-10 60 ◆ SEDIMENT SAMPLE LOCATION (UNNAMED TRIB) NICKEL CONCENTRATION IN MG/KG

—320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTE: ONE COLOR REPRESENTS TWO DIFFERENT HABITAT ASSESSMENT-BASED CRITERIA FOR THE TWO SEPARATE AREAS FOR THE PURPOSES OF DEVELOPING REMEDIAL ALTERNATIVES.

FURNACE BROOK/UNNAMED POND SYSTEM NOTES

1. THE HABITAT ASSESSMENT-BASED PRG FOR NICKEL IS 200 MG/KG.

>200 MG/KG NICKEL

UNNAMED TRIBUTARY SYSTEM NOTE:

1. THE HABITAT ASSESSMENT-BASED PRG FOR NICKEL IS 143 MG/KG.

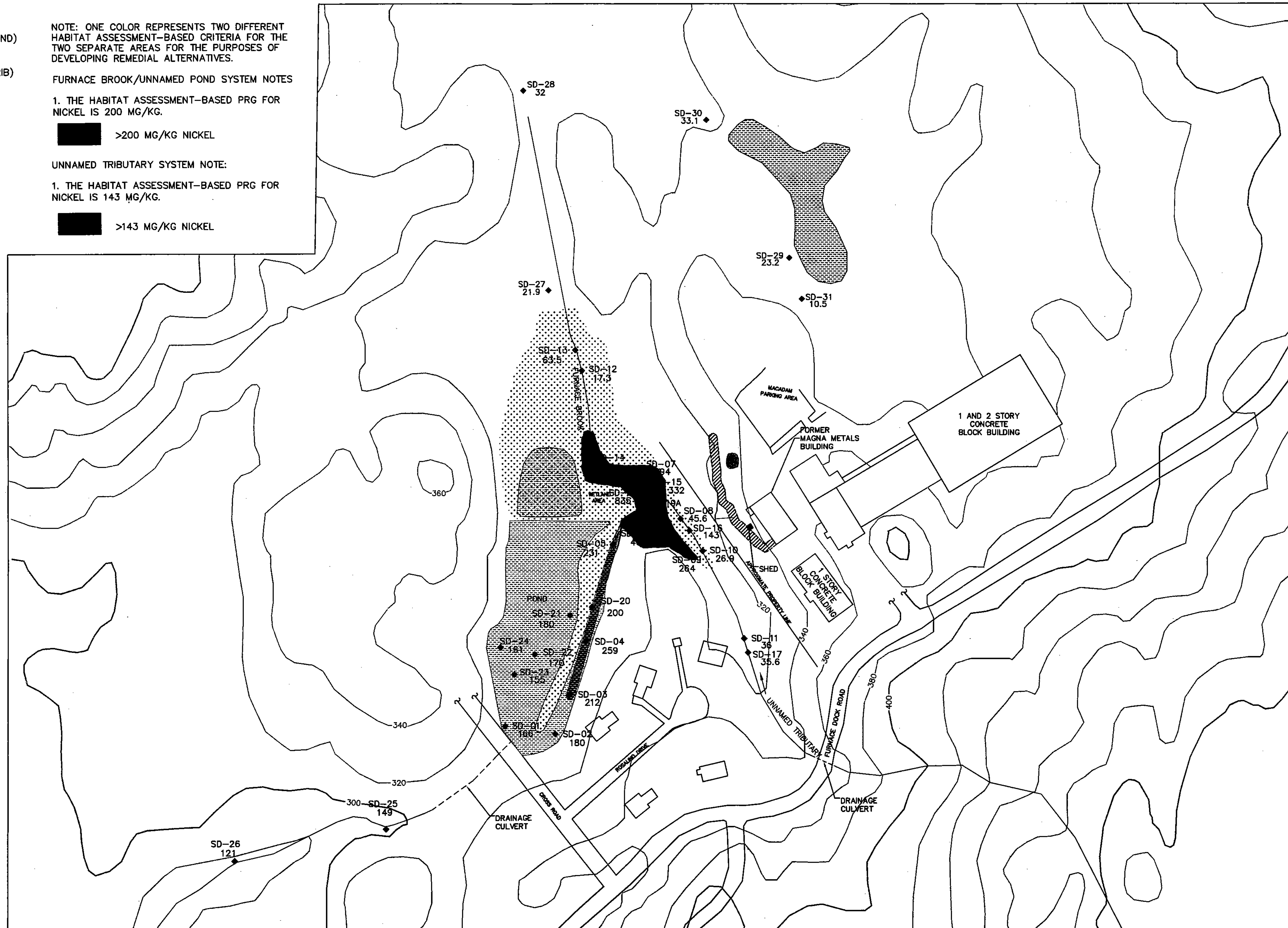
>143 MG/KG NICKEL

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.
2. SD-27 THROUGH SD-31 ARE BACKGROUND SAMPLE LOCATIONS.
3. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.
4. THE EXTENT OF THE CONTAMINATED AREA IS APPROXIMATE.
5. SAMPLE LOCATIONS FOR SD-13 TO SD-26 ARE BASED ON GPS COORDINATES.

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.
2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.
3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.
5. TOPOGRAPHIC LINES ARE APPROXIMATE.

0 125 250
FEET

N



TETRA TECH EC, INC.	TITLE: Nickel in Off-Site Sediment Above Habitat Assessment-Based PRGs Magna Metals Cortlandt, New York	DWN: LMC CHKD: DATE: 12/10/09	DES.: EAG APPD: REV.: 0	PROJECT NO.: 106-1172 FIGURE NO.: 2-5

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 2-5 NICKEL IN OFF-SITE SED 121009.DWG

BCLP04187

LEGEND

SD-18 ◆ 220 SEDIMENT SAMPLE LOCATION COPPER CONCENTRATION IN MG/KG

—— 320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

1. THE PRE-RELEASE REMEDIAL GOAL FOR COPPER IS 13.7 MG/KG.
2. THE NYSDEC LEL FOR COPPER IS 16 MG/KG.
3. CONCENTRATIONS FROM UPGRADIENT SAMPLES SD-12, SD-13, AND SD-29 THROUGH SD-31 ARE EXCLUDED IN CONCEPTUAL ILLUSTRATIONS.
4. EXCEEDANCES OF THE PRE-RELEASE REMEDIAL GOAL FOR COPPER ARE CO-LOCATED WITHIN THE AREA OF THE NYSDEC LEL EXCEEDANCES.

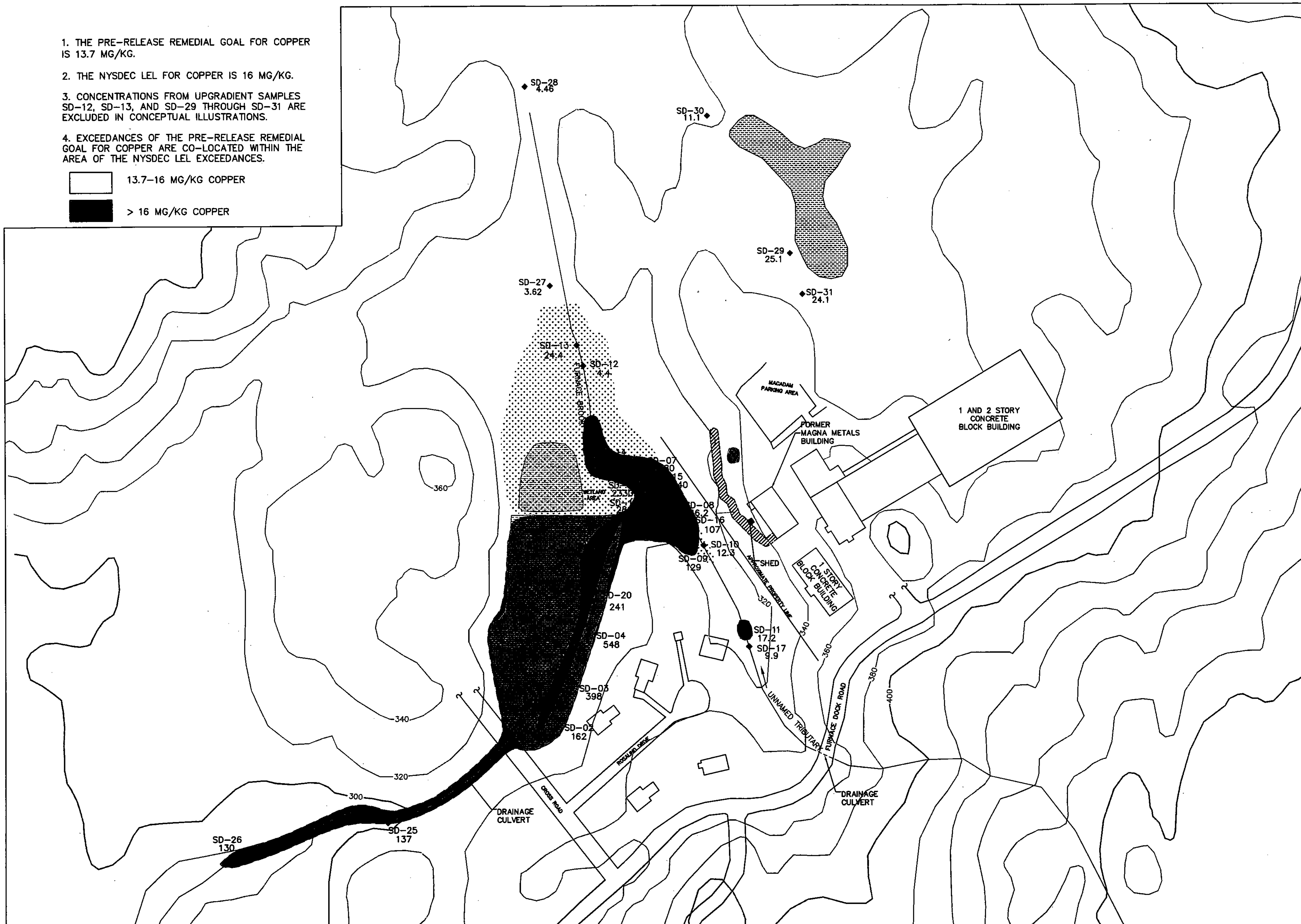
13.7-16 MG/KG COPPER

> 16 MG/KG COPPER

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.
2. SD-27 THROUGH SD-31 ARE BACKGROUND SAMPLE LOCATIONS.
3. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.
4. THE EXTENT OF THE CONTAMINATED AREA IS APPROXIMATE.
5. SAMPLE LOCATIONS FOR SD-13 TO SD-26 ARE BASED ON GPS COORDINATES.

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.
2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.
3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.
5. TOPOGRAPHIC LINES ARE APPROXIMATE.

0 125 250
FEET



TETRA TECH EC, INC.	TITLE: Copper in Off-Site Sediment Above Pre-Release Conditions and LELs Magna Metals Cortlandt, New York	DWN: LMC CHKD: DATE: 12/10/09	DES.: EAG APPD: REV.: 0	PROJECT NO.: 106-1172 FIGURE NO.: 2-6

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 2-6 COPPER SED PRE-RELEASE AND LEL 121009.DWG

BCLP04188

LEGEND

SD-18 ◆ 220 SEDIMENT SAMPLE LOCATION NICKEL CONCENTRATION IN MG/KG

——320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

1. THE PRE-RELEASE REMEDIAL GOAL FOR NICKEL IS 24.1 MG/KG.

2. THE NYSDEC LEL FOR NICKEL IS 16 MG/KG.

3. CONCENTRATIONS FROM UPGRADIENT SAMPLES SD-12, SD-13, AND SD-29 THROUGH SD-21 ARE EXCLUDED IN CONCEPTUAL ILLUSTRATIONS.

4. EXCEEDANCES OF THE NYSDEC LEL FOR NICKEL ARE CO-LOCATED WITHIN THE AREA OF THE PRE-RELEASE EXCEEDANCES.

16-24.1 MG/KG NICKEL

> 24.1 MG/KG NICKEL

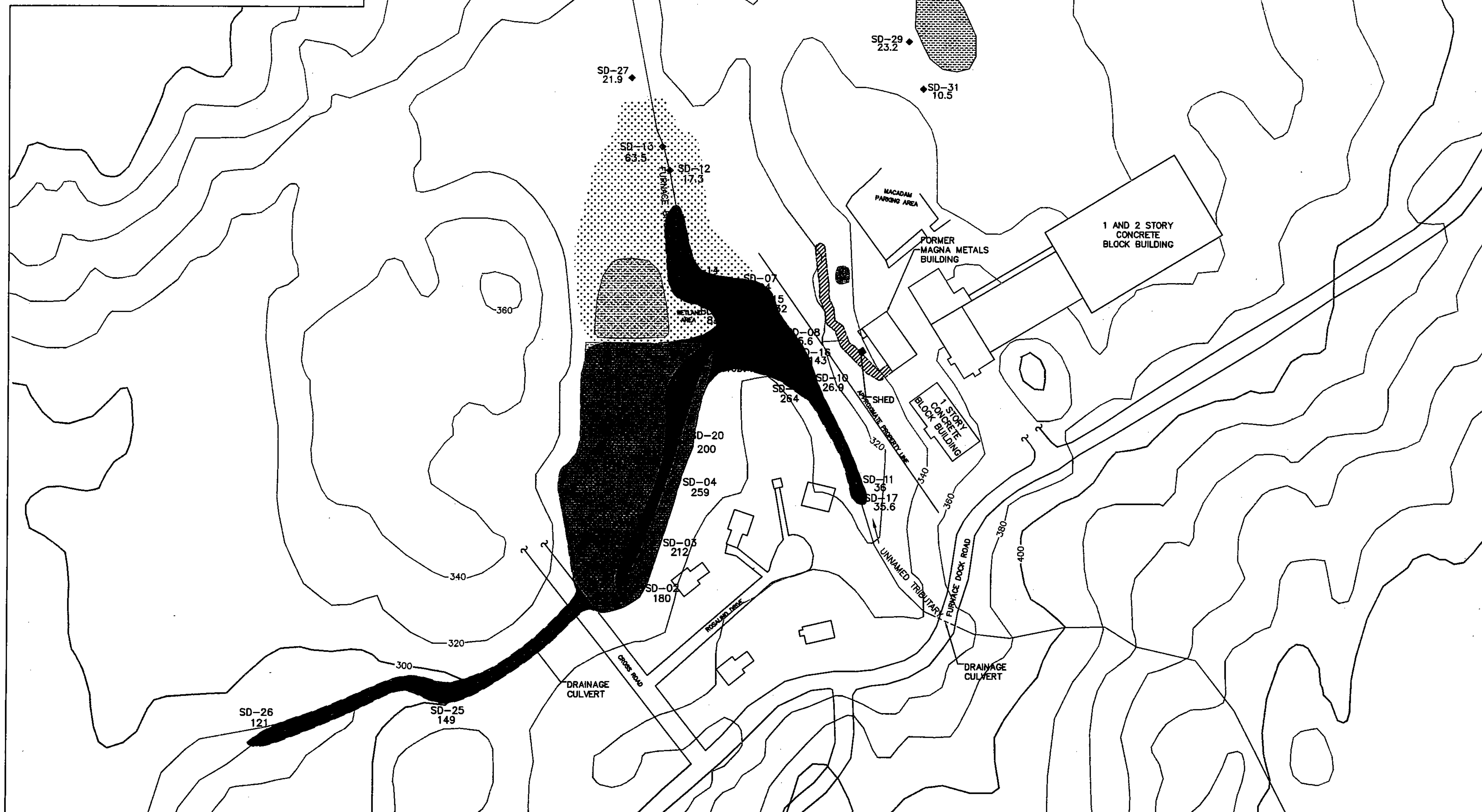
NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.

2. SD-27 THROUGH SD-31 ARE BACKGROUND SAMPLE LOCATIONS.

3. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.

4. THE EXTENT OF THE CONTAMINATED AREA IS APPROXIMATE.

5. SAMPLE LOCATIONS FOR SD-13 TO SD-26 ARE BASED ON GPS COORDINATES.



SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.

2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.

3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.

4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.

5. TOPOGRAPHIC LINES ARE APPROXIMATE.

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FEET

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TETRA TECH EC, INC.

TITLE:
Nickel in Off-Site Sediment Above Pre-Release Conditions and LELs
Magna Metals
Cortlandt, New York

DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
CHKD:	APPD:	FIGURE NO.: 2-7
DATE: 12/10/09	REV.: 0	

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 2-7 NICKEL SED PRE-RELEASE AND LEL 121009.DWG

BCLP04189

LEGEND

SD-18 ◆ 290 SEDIMENT SAMPLE LOCATION ZINC CONCENTRATION IN MG/KG

——320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

1. THE PRE-RELEASE REMEDIAL GOAL FOR ZINC IS 54.1 MG/KG.

2. THE NYSDEC LEL FOR ZINC IS 120 MG/KG.

3. CONCENTRATIONS FROM UPGRADIENT SAMPLES SD-12, SD-13, AND SD-29 THROUGH SD-21 ARE EXCLUDED IN CONCEPTUAL ILLUSTRATIONS.

54.1-120 MG/KG ZINC

> 120 MG/KG ZINC

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.

2. SD-27 THROUGH SD-31 ARE BACKGROUND SAMPLE LOCATIONS.

3. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.

4. THE EXTENT OF THE CONTAMINATED AREA IS APPROXIMATE.

5. SAMPLE LOCATIONS FOR SD-13 TO SD-26 ARE BASED ON GPS COORDINATES.

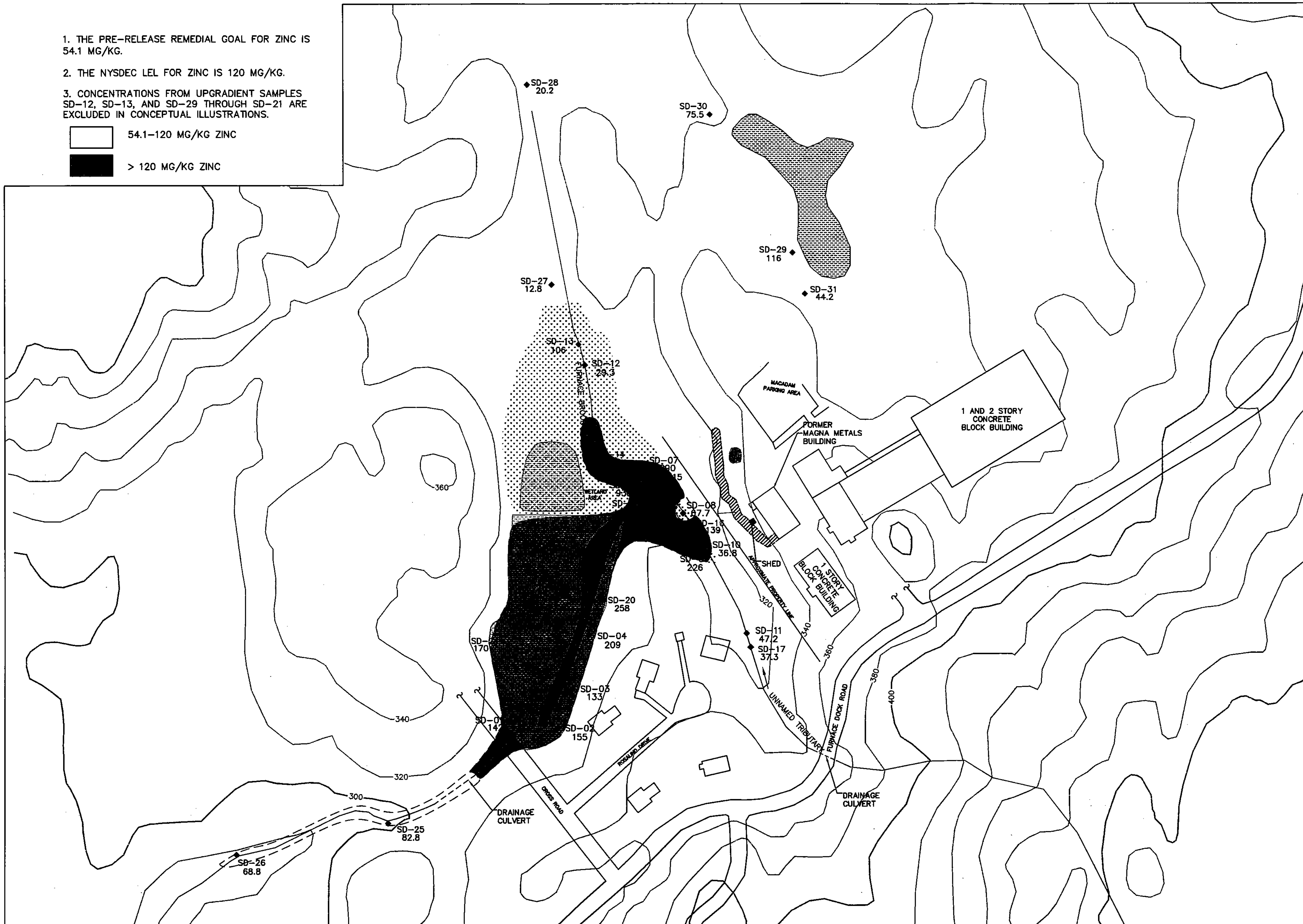
SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.

2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.

3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.

4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.

5. TOPOGRAPHIC LINES ARE APPROXIMATE.



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FEET

N

TETRA TECH EC, INC.

TITLE: Zinc in Off-Site Sediment Above Pre-Release Conditions and LELs
Magna Metals
Cortlandt, New York

DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
CHKD:	APPD:	
DATE: 12/10/09	REV.: 0	FIGURE NO.: 2-8

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 2-8 ZINC SED PRE-RELEASE AND LEL 121009.DWG

BCLP04190

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND SELECTION OF PROCESS OPTIONS

The screening of remedial technologies is performed in two steps: (1) the identification and screening of technology types and process options for each general response action, and (2) the evaluation and selection of representative process options. The following sections discuss the results of these steps.

3.1 Identification and Screening of Technologies

Remedial technology types associated with each of the GRAs are discussed in this section. Most of these remedial technology types contain several different process options that could be applicable to the remediation of contaminated soil, groundwater, and sediment. These potentially applicable technologies and process options are initially screened based on technical feasibility, considering site-specific conditions, contaminant types, and concentrations, to select representative technologies and process options for development of remedial alternatives.

3.1.1 Soil

In this section, potential technologies for remediation of contaminated soil exceeding PRGs are discussed and summarized with the results of the initial screening. For those technologies that were not retained for further evaluation, the rationale for their elimination is included. Table 3-1 summarizes the results of the preliminary screening of soil technologies and process options discussed below.

3.1.1.1 No Action

Description: No Action is a response that does not include any remedial measures. No Action allows for periodic reviews of the site and reevaluation of the need for remedial action at periodic intervals.

Initial Screening: No active remediation or institutional controls are implemented under this option. Any reduction in the toxicity, mobility or volume of contaminants would be the result of natural attenuation, since no treatment would be implemented. The No Action alternative is retained for further evaluation as a baseline for comparison of other alternatives.

3.1.1.2 Limited Action

Limited Action consists of technologies that are generally passive, including monitoring, access restrictions (e.g., engineering controls such as fencing and warning signs) and institutional controls (e.g., environmental easements, health and safety plans, Site Management Plans, etc.).

TABLE 3-1
SCREENING OF SOIL TECHNOLOGIES AND PROCESS OPTIONS

General Response Actions	Remedial Technology Types	Process Options	Technical Feasibility
No Action	No Action	Site Reviews	Retained
Limited Action	Access Restrictions	Access Restrictions	Retained
	Institutional Controls	Environmental Easements	Retained
		Health and Safety Plan and Site Management Plan	Retained
	Monitoring	Monitoring and Site Reviews	Retained
Containment	Capping	Permeable Soil	Retained
		Clay	Retained
		Asphalt	Retained
		Multi-Media	Retained
	Barrier Walls	Sheet Piling	Not Retained
		Slurry Walls	Not Retained
		Grouting	Not Retained
Removal/Treatment/ Disposal	Removal	Excavation	Retained
	In Situ Treatment	Soil Vapor Extraction	Not Retained
		Soil Flushing/Washing	Not Retained
		Stabilization/ Solidification	Retained
		Steam stripping (DUS)	Not Retained
		Biodegradation	Not Retained
		Oxidation	Not Retained
	Ex Situ Treatment	Reuse/Recycling	Retained
		Stabilization/ Solidification	Retained
		Thermal Desorption	Not Retained
		Incineration	Not Retained
		Biodegradation	Not Retained
		Soil Washing	Not Retained
		Soil Vapor Extraction	Not Retained
		Chemical Oxidation	Not Retained
	Disposal	On-site Landfill	Not Retained
		Off-site Disposal	Retained

3.1.1.2.1 Access Restrictions

Description: Access to contaminated areas would be restricted by providing a security fence and affixing signs (as appropriate).

Initial Screening: Fencing around the impacted soil areas would effectively prevent exposure to the impacted materials. This process option is retained for further evaluation.

3.1.1.2.2 Environmental Easements

Description: This process option includes the use of environmental easements to ensure the performance of operation, maintenance, and/or monitoring requirements and the potential restriction of future uses on properties that have residual contamination above unrestricted use criteria, or which have engineering controls that must be maintained or protected.

Initial Screening: Environmental easements are required for sites with residual contamination above unrestricted use criteria and for sites with engineering controls that provide protection of human health and/or the environment and must be maintained and/or monitored. Although difficulties may occur with third party owners, this process option is retained.

3.1.1.2.3 Health and Safety and Site Management Plans

Description: This process option includes the preparation, implementation and maintenance of plans for the property to manage future activities at the Site. The plans, which could include a Health and Safety Plan and/or a Site Management Plan, would require monitoring and use of personal protective equipment during construction activities at the site.

Initial Screening: Plans would be required as the final step in the development of remedial alternatives that do not remediate the site to unrestricted use conditions. Plans are retained as a process option.

3.1.1.2.4 Monitoring and Site Reviews

Description: This process option includes periodic data collection (e.g., quarterly, annual, etc.) and review of the data to assess the current conditions at the site. These data would be used to determine if implemented remedial activities have achieved the RAOs or are continuing to be protective of health and the environment as conditions improve towards achieving the RAOs. Should site reviews indicate conditions are worsening or the current conditions pose an unacceptable risk to health or the environment, additional activities could be implemented.

Initial Screening: Periodic monitoring and site reviews are necessary to assess the progress of remedial activities and the protectiveness of implemented actions until RAOs are achieved. They are a necessary component of nearly all remedial actions, the exception being those that immediately achieve RAOs, and are therefore retained as a process option.

3.1.1.3 *Containment*

Containment provides isolation of contaminated soil from potential receptors and/or uncontaminated media. Capping technologies and/or vertical barriers can be used to contain contaminated soil, minimize exposure to contaminated soil, control migration of contaminants, and reduce leaching of contaminants from the soil to groundwater. Capping of contaminated soil could be achieved by using permeable soil caps, clay caps, asphalt caps, and multiple layer caps. Vertical barriers, including sheet piling, slurry walls and grout curtains, were not retained due to the potential pathway to underlying bedrock. However, sheet piling may be used in conjunction with deep excavation activities.

3.1.1.3.1 *Permeable Soil Cap*

Description: A permeable soil cap can be installed over contaminated soil to mitigate direct contact with contaminants. A permeable soil cap would have a high permeability relative to clay, and would allow percolation of surface water, runoff, etc.

Initial Screening: A permeable soil cap would be effective in mitigating direct contact with contaminated surface soils; however, soil caps do not reduce contaminant migration to groundwater. Permeable soil caps are susceptible to erosion from climatic and storm forces; this can be mitigated with a properly maintained vegetative cover. Permeable soil caps are also susceptible to settling, ponding of liquids, and invasion by burrowing animals and deep rooted vegetation if not properly maintained. This option is retained for contaminated surface and subsurface soils.

3.1.1.3.2 *Clay Cap*

Description: Clay caps are commonly used for soil that contains hazardous or non-hazardous waste. Bentonite, a natural clay with high swelling properties, is often mixed with on-site soil and water to produce a low permeability layer. A low permeability clay cap would not only physically isolate the source, but also reduce the potential for leaching of contaminants to groundwater by creating a low permeability barrier.

Initial Screening: A clay cap would be effective in mitigating direct contact with contaminated soils and would also mitigate contaminant migration by reducing surface infiltration; however, clay caps do not mitigate contaminant migration beneath the water table. Clay, which consists of fine material, is susceptible to erosion from climatic and storm forces; this can be mitigated with a properly maintained vegetative cover. Proper particle distribution is essential to create a low permeability cap. Clay caps are also susceptible to cracking, settling, ponding of liquids and invasion by burrowing animals and deep rooted vegetation if not properly maintained. This option is retained for the contaminated surface and subsurface soils.

3.1.1.3.3 *Asphalt Cap*

Description: An asphalt cap would consist of graded soil and a gravel sub-base, with asphalt paving as a final cover. The cap minimizes wind and rain erosion, preserves slope stability, and provides protection from the elements for layers below it.

Initial Screening: Asphalt caps provide a low permeability cover to mitigate direct contact with contaminated soils and reduce infiltration; however, asphalt caps do not mitigate contaminant migration beneath the water table. They are less susceptible to erosion from climatic and storm forces than a soil or clay cap. An asphalt cap is subject to cracking and settling if not properly maintained. However, it would be effective in achieving remedial action objectives for soil including mitigating direct contact with contaminated soils. Therefore, this option is retained.

3.1.1.3.4 Multi-Media Cap

Description: A multi-media cap is a combination of two or more of the single layer capping technologies. A disadvantage of one is compensated for by an advantage of another. Most caps recommended for hazardous waste projects are multi-layer caps. A multi-media cap would typically consist of 2 feet of clay, a synthetic liner, filter fabric, 1 foot of sand, 2 feet of top soil, and vegetation at the top.

Initial Screening: The performance of a properly installed, multi-layered cap is generally excellent. There is still a need for periodic monitoring and maintenance of the cap but to a lesser extent than a single media cap. This type of cap would require more restrictions on future use of the site and would be less practical to install around buildings and on small areas while offering little increased benefit. However, this type of cap has the advantage of reducing infiltration, in addition to minimizing exposure. Therefore, this option is retained.

3.1.1.3.5 Sheet Piling

Description: This technique could be used as a vertical barrier whereby the soil within the enclosure is dewatered and soil remedial activities could proceed in a "dry" state. Steel or heavy gauge PVC sheet piling cutoffs require very little maintenance. Recent advances in jointing technology have made sheet piling relatively resistance to leakage.

Initial Screening: Sheet piling is not feasible for source control due to the potential vertical migration pathway to underlying bedrock. However, sheet piling may be used in conjunction with soil excavation for dewatering purposes.

3.1.1.3.6 Slurry Walls

Description: Slurry walls are a common subsurface barrier because they are a relatively inexpensive means of reducing groundwater flow through contaminated source materials. Slurry walls are constructed in a vertical trench excavated under a slurry. This slurry, usually a mixture of bentonite and water, acts essentially like a drilling fluid. It hydraulically shores the trench to prevent collapse, and at the same time, forms a filter cake on the trench walls to prevent high fluid losses into the surrounding ground. In some cases, soil or cement are added to the bentonite slurry to form a soil-bentonite or cement-bentonite slurry wall. Slurry wall installation typically requires the handling of potentially contaminated excess spoils.

Initial Screening: Slurry walls are typically used when they can be "keyed" into a confining layer. This option is not retained due to the potential vertical migration pathway to underlying bedrock.

3.1.1.3.7 Grouting

Grouting is typically accomplished by drilling a grout tool down to a given depth and then raising up the tool while injecting grout through the jet. The actual grouting injection locations may be at plan intervals close enough to ensure overlap of the known radius of a jet tool, or may be further apart based on the ability of the grout to penetrate undisturbed soils that are beyond the tool radius. This technique can be used to construct a full or partial vertical barrier.

Initial Screening: This process typically results in an excess spoils volume, and this material has to be managed and in most cases disposed of. This process is not retained due to the potential vertical migration pathway to the underlying bedrock layer.

3.1.1.4 Removal

Removal technologies involve physical removal of contaminated soil, usually with the intention of subsequent treatment and/or disposal. This category includes excavation and is a preliminary or support technology as part of *ex situ* treatment options which first require removal of the contaminated media.

3.1.1.4.1 Excavation

Description: Excavation refers to the use of construction equipment such as backhoes, bulldozers, front end loaders, and clamshells that are typically used on land to excavate and handle contaminated soil. Excavation could also be used to access contamination source areas (*e.g.*, leach pits) to provide a means for physical removal of contaminated subsurface soil.

Initial Screening: Excavation would be required as the initial material handling step in numerous remedial alternatives. The excavation areas would be restored with clean backfill which may serve as a physical barrier to subsurface contamination that may not be excavated. Excavation is retained for the source areas and the contaminated soils.

3.1.1.5 In Situ Treatment

Treatment technologies are used to change the physical or chemical state of a contaminant or to destroy the contaminant completely to reduce volume, toxicity and/or mobility of the contaminant. *In situ* treatment is a technology category in which contaminated soil is treated "in place", without removal of the soil media. The technologies evaluated in this category are soil vapor extraction, soil flushing/washing, stabilization/solidification, steam stripping, biodegradation, and chemical oxidation.

3.1.1.5.1 Soil Vapor Extraction

Description: Vapor extraction wells are installed throughout the impacted material down to the water table. Through a network of piping, a vacuum is applied to the wells to draw off the constituents as a vapor. Some variations utilize injected air into wells within the water table combined with vacuum extraction to liberate contaminants within the groundwater along with vadose zone contamination. The removed vapor sometimes requires further treatment via thermal oxidation or carbon adsorption prior to release to the atmosphere.

Initial Screening: Soil vapor extraction is not effective at removing inorganics in soils and is therefore not retained as a potential technology. However, a Sub Slab Depressurization System is included with groundwater alternatives due to the presence of VOCs in sub slab vapor.

3.1.1.5.2 In Situ Soil Flushing/Washing

Description: Inorganics can be washed from contaminated soils by means of an extraction process termed "soil washing." An aqueous solution (e.g., surfactant) is injected into the area of impacted material. As the aqueous solution flows through the impacted media, sorbed contaminants are mobilized into solution by reason of solubility, formation of an emulsion, or by chemical reaction with the flushing solution. The solution, combined with the removed constituents, is then extracted from the subsurface utilizing wells and multi-phase extraction methods. Additional processes can be used to enhance the removal of insoluble contaminants. Additional treatment of the extracted aqueous waste is necessary prior to disposal.

Initial Screening: *In situ* soil washing relies on the hydraulic conductivity and homogeneity of the subsurface medium for proper transmission of the washing reagent throughout the saturated zone and contact with contaminants of concern. The site geology includes fine grained soils (*i.e.*, clays and silts) which could negatively impact the ability of the washing reagent to reach the contaminants of concern and could also negatively impact ease of extraction. The low solubility of the heavier inorganics in the impacted areas could prevent effective soil washing even in areas with less fine grained soils. Additionally, when used over a wide area, this process could also generate a substantial quantity of wastewater that would require treatment and disposal. In addition, close to the streams and unnamed pond, there is a potential to mobilize contamination and therefore a potential to discharge contaminated water to the various water bodies. Therefore, this technology is not retained.

3.1.1.5.3 In Situ Stabilization/Solidification

Description: *In situ* stabilization is a process whereby contaminated soils are converted in-place into a stable cement type matrix in which contaminants are bound or trapped and become immobile. Silicates can stabilize contaminants such as metals. It has been demonstrated that chemical fixation products of certain silicate-based mixtures do not leach metals and most organics. Large augers are used to inject the stabilizing reagents and mix the impacted material. Treatment may be achieved in both the saturated and unsaturated zones with this technology.

Initial Screening: For the site contaminants and physical conditions present, this process option could effectively reduce the risks associated with soils at the Site. Treatability studies would be required prior to design of an *in situ* stabilization remedy for the site. This technology is retained for further evaluation.

3.1.1.5.4 *In Situ Steam Stripping (Dynamic Underground Stripping (DUS))*

Description: *In situ* steam stripping is a physical separation treatment process that utilizes steam introduced into the impacted material to strip off organic constituents. Steam is injected into the periphery of the contaminated areas to vaporize and mobilize contaminants, which are then extracted at centrally located vapor and liquid extraction points. In combination, electrical heating may be used to vaporize contaminants in less permeable zones or lenses. Vapor and liquid collection and treatment systems would be required to process the extracted liquid and vapor prior to disposal. Treatment is achieved in both the saturated and unsaturated zones.

Initial Screening: For the site contaminants and physical conditions present, this process would not effectively reduce the risks associated with soils at the Site. Inorganics, the predominant contaminants of concern in soils, would not be effectively treated by *in situ* steam stripping. Therefore, this technology is not retained for further evaluation

3.1.1.5.5 *In Situ Biodegradation*

Description: Biological treatment involves the use of native microbes or selectively adapted bacteria to degrade a variety of organic compounds. The biological processes usually involve the addition of microbes, nutrients, and oxygen. To enhance the performance of microbial activity in the subsurface, oxygen is added to the saturated zone via either an oxygen releasing compound or controlled direct injection of air or oxygen itself. Treatment is generally only accomplished in the saturated zone.

Initial Screening: This process option is not effective for inorganics in soils. Therefore, this technology is not retained for further evaluation.

3.1.1.5.6 *In Situ Chemical Oxidation*

Description: This technology involves the use of a chemical reagent that is injected into the soil via constructed wells or driven wellpoints to break down organic constituents into carbon dioxide and water. Generally, a hydrogen peroxide based mixture is used, with additives and catalysts to enhance the reaction characteristics. The amount of reagent needed, spacing of injection points, and the frequency of addition to achieve cleanup goals are dependent upon organic concentrations and soil characteristics.

Initial Screening: This technology is not well established for inorganics in soils. Therefore, this process option is not retained for further evaluation.

3.1.1.6 *Ex Situ Treatment*

Treatment technologies may be implemented *ex situ*, i.e., after excavation of contaminated soil. The process options for *ex situ* treatment technologies that were evaluated included: reuse/recycling, stabilization/solidification, thermal desorption, incineration, biodegradation, soil washing and soil vapor extraction.

3.1.1.6.1 Reuse/Recycling

Description: This category of process options includes the processing of impacted material from the Site that as part of a process to produce a useable end product. Process options include: cold batch asphalt (on or off-site), hot mix asphalt batching, brick manufacturing, cement manufacturing, and co-burning in an industrial boiler. In addition, it is sometimes practical to use lime to amend soils for moisture and to re-use slightly impacted soils at sites, thereby reducing the amount of imported backfill that is needed, and reducing the amount of off-site disposal that is required to remediate a site.

Initial Screening: Excavation of soils from source areas may not result in reusable soils. This option may be applicable for the reuse of slightly or non-impacted soils located outside of the source areas, and is retained.

3.1.1.6.2 Solidification/Stabilization

Description: Stabilization is a process whereby contaminated soils are converted into a stable cement type matrix in which contaminants are bound or trapped and become immobile. Generally, cementing additives are used, with other reagents as necessary to stabilize the organic constituents present in the site soil. A pug mill is used to thoroughly mix the impacted material with the additives.

Initial Screening: This process would be effective for the impacted material. This technology would immobilize contaminants in the soil matrix and would require long-term monitoring at the point of disposal. Bench-scale testing would be required to identify the appropriate additives and dosage rates. This technology can be used for effective immobilization of constituents present at the site and therefore is retained as a process option.

3.1.1.6.3 Thermal Desorption

Description: The thermal desorption technology is a thermal stripping process. Prepared soils are introduced into the enclosed heated chamber using a heated screw or belt conveyor. Direct or indirect heating methods are used to volatilize organics from the soil. The off-gas containing the thermally stripped compounds is then combusted in an afterburner, adsorbed in a carbon adsorption unit or treated by catalytic oxidation designed to ensure removal of these compounds to acceptable levels. Typical operating temperatures for thermal stripping of organics are 400°F to 900°F; however, higher temperatures are achievable. Operating temperatures are selected based on the hydrocarbons present in the soil.

Initial Screening: This process would not be effective for inorganics, the predominant constituents of concern in soils at the Site. Therefore, this technology is not retained for further evaluation.

3.1.1.6.4 Incineration

Description: Incineration is a thermal destruction method which can be used to destroy combustible waste materials including organic contaminants in soils. Incineration systems such as multiple hearth, rotary kiln, infrared and fluidized bed can treat highly-contaminated soils at high temperatures (1200°F to 1800°F in the primary chamber and at 1400°F to 2400°F in the secondary chamber). Infrared incineration systems are used primarily for solids or sludges.

Initial Screening: High temperature incineration is not suitable for removal of inorganics in contaminated soils. Therefore, incineration is not retained as an option.

3.1.1.6.5 Biodegradation

Description: Biological treatment involves the use of native microbes or selectively adapted bacteria to degrade a variety of organic compounds. The biological processes usually involve the addition of microbes, nutrients, oxygen and moisture. The microbial action serves to effectively degrade the organic constituents. Several options for implementing this approach on-site for excavated materials exist, including: constructing a biopile, landfarming, or composting. The option that would be most appropriate for this site is the construction of an engineered biopile. In order to minimize odors from this process, the pile would be covered with a heavy polyethylene sheeting.

Initial Screening: Aerobic biodegradation has not been demonstrated to be effective on inorganic constituents. Therefore, on-site *ex situ* biodegradation is not retained.

3.1.1.6.6 Soil Washing

Description: Soil washing of excavated soil involves processing the impacted material in a reactor vessel, or other treatment unit in conjunction with a reagent solution designed to remove the organic constituents from the native soil. The optimum reagent and reaction time would require the performance of bench and pilot studies to optimize the process.

Initial Screening: *Ex situ* soil washing overcomes heterogeneity concerns associated with *in situ* soil washing. Large volumes of aqueous wastes would also be generated and would require further treatment and disposal. Furthermore, significant feedstock preparation is required for this process option. Therefore, this process option is not retained.

3.1.1.6.7 Soil Vapor Extraction

Description: This process option involves the construction of engineered stockpiles of impacted soil after excavation. Slotted pipes are installed within the stockpiles and a vacuum is applied to draw off the volatile organic constituents. An emissions control system is required to treat extracted vapor prior to release to the environment.

Initial Screening: This process is not effective for the treatment of inorganics, therefore, this option is not retained for further evaluation.

3.1.1.6.8 Chemical Oxidation

Description: This technology involves the use of a chemical reagent that is injected into stockpiled soil to chemically convert hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Oxidation reactions involve the transfer of electrons from one compound to another. The oxidizing agents most commonly used for treatment of hazardous contaminants are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. Chemical oxidation is a short- to medium-term technology. Generally, a hydrogen peroxide based mixture is used, with additives and catalysts to enhance the reaction characteristics. The amount of reagent needed, spacing of injection points, and the frequency of addition to achieve cleanup goals are dependent upon organic concentrations and soil characteristics.

Initial Screening: The target contaminant group for chemical oxidation is organics. Therefore, this process option is not retained for further evaluation.

3.1.1.7 Disposal

This category of remedial process options refers to disposal of impacted soil on or off-site, with or without prior treatment. The remedial technologies are on-site landfill (with or without treatment) and off-site disposal (with or without treatment).

3.1.1.7.1 On-Site Landfill

Description: Impacted soil would be excavated and then disposed of in an on-site landfill. A regulated landfill would have to be constructed on-site, including liner system, leachate collection and treatment, and multi-layer cap.

Initial Screening: An onsite landfill would have to meet rigorous regulatory requirements. The depth to groundwater is not sufficient to allow for the construction of an efficient landfill, and there is not sufficient space available on-site for this option; therefore, this option is not retained.

3.1.1.7.2 Off-Site Disposal

Description: Hazardous impacted material (if any) would be transported to a regulated facility and properly disposed of following treatment to meet LDRs if necessary. Non-hazardous soil can be directly disposed of off-site in a non-hazardous landfill or potentially reused (e.g., as landfill cover) after treatment (if appropriate) in accordance with NYSDEC rules.

Initial Screening: Offsite disposal to a landfill either directly or after treatment is a viable option. Both hazardous and non-hazardous materials may be encountered during remedial operations. Both materials would have to be managed and therefore this option is retained.

3.1.2 Groundwater

In the following sections, potential groundwater remedial technologies are briefly described and summarized with the results of the screening. Technologies capable of addressing VOC and inorganics impacts to groundwater are identified as such. For those technologies that were not retained, the rationale for their elimination is included. Table 3-2 summarizes the results of the preliminary screening of groundwater technologies and process options discussed below.

3.1.2.1 *No Action*

Description: No Action provides no institutional controls of active remediation, but includes periodic reviews to assess the need for future remedial actions.

Initial Screening: No action would not provide any remedial action. Although the No Action alternative would not meet remedial objectives, it is retained throughout the detailed evaluation as a baseline for comparison of other alternatives.

3.1.2.2 *Limited Action*

Limited Action is a category of institutional controls that includes use restrictions, planning, long-term monitoring and periodic site reviews to assess migration of contaminants.

3.1.2.2.1 *Institutional Controls*

Description: Institutional controls as applied to groundwater include public notification measures and use restrictions to control exposure to site conditions.

Some actions included in this category could be restrictions placed on the property to restrict use of the site groundwater, and actions initiated by the local government or the state to restrict or regulate the installation of new wells. Other actions could include implementation of a health and safety plan that would establish guidelines for groundwater management and use in the area.

Initial Screening: Currently, groundwater is not used at the former ISCP property; however, to prevent future use, restrictions and other institutional controls would ensure that the currently incomplete groundwater exposure pathway remains incomplete as long as groundwater contaminant concentrations exceed Class GA standards. Institutional controls are retained.

3.1.2.2.2 *Monitored Natural Attenuation*

Description: Monitored Natural Attenuation (MNA) relies on natural processes to achieve RAOs within a reasonable timeframe. Implementation of MNA includes a comprehensive monitoring program to verify MNA is occurring, detect any changes in the environment that may reduce the effectiveness of MNA, identify any toxic or mobile transformation products, verify the plume is not expanding, and verify no negative impacts on downgradient receptors. Monitoring would continue for some period of time after Class GA standards are achieved to ensure that contaminant levels do not rebound.

Initial Screening: An MNA analysis would be required. If source control measures are implemented (*e.g.*, removal of source areas), an MNA analysis would be completed to show the effect on VOCs in site groundwater. The results of various groundwater sampling events between 1997 and 2006 have shown reductions in concentrations of contaminants of concern in groundwater (see RI data) and have also shown the possibility of a natural PCE dechlorination process occurring on the Site due to the development of PCE daughter products (*i.e.*, TCE and DCE). Therefore, this approach will be retained for consideration in conjunction with source reduction measures.

TABLE 3-2
SCREENING OF GROUNDWATER TECHNOLOGIES AND PROCESS OPTIONS

General Response Actions	Remedial Technology Types	Process Options	Technical Feasibility
No Action	No Action	Site Reviews	Retained
Limited Action	Institutional Controls	Use Restrictions	Retained
		Health and Safety Plan	Retained
		Monitored Natural Attenuation	Retained
Containment	Barrier Walls	Sheet Piling	Not Retained
		Slurry Walls	Not Retained
		Grouting	Not Retained
		Hydraulic Containment	Not Retained
Removal/Treatment/ Disposal	Removal	Extraction Wells	Not Retained
	In Situ Treatment	PRB	Not Retained
		Biodegradation	Retained
		Chemical Oxidation/Ozonation	Retained
		Carbon Adsorption	Not Retained
		Air Sparging	Retained
	Ex Situ Treatment	Air Stripping	Not Retained*
		Carbon Adsorption	Not Retained*
		Filtration	Not Retained*
		UV-Oxidation	Not Retained*
		Ion Exchange	Not Retained*
		Reverse Osmosis	Not Retained*
		Biological Treatment	Not Retained*
	Disposal	Discharge to Groundwater	Not Retained*
		Discharge to Surface Water	Not Retained*
		Discharge to POTW	Not Retained*

* *Ex Situ* treatment technologies and process options were not considered feasible due to site hydraulic conditions.

3.1.2.3 *Containment*

Containment is a remedial technology capable of providing isolation of contaminated groundwater from uncontaminated groundwater and preventing groundwater discharge to surface water bodies. Containment technologies include vertical barriers such as sheet piling and slurry walls in order to form a barrier to contaminant migration. It may be necessary to provide groundwater removal behind the barrier to prevent excess mounding and the potential spread of impacted groundwater around the barrier.

3.1.2.3.1 *Sheet Piling*

Description: Sheet piling driven into the soil can be used as a barrier to limit the migration of contaminants via groundwater if the sheet piling can be "keyed" into an underlying layer of low permeability. This technique could also be used during soil excavation whereby the soil within the enclosure is dewatered and soil remedial activities could proceed in a "dry" state. Steel or heavy gauge PVC sheet piling cutoffs require very little maintenance. Recent advances in jointing technology have made sheet piling relatively resistance to leakage.

Initial Screening: Sheet piling can be used in any hydraulic condition (such as low or high groundwater movements). However, the potential of contaminant migration to the underlying bedrock layer would reduce the effectiveness of sheet piling as a barrier to migration. Therefore, the use of sheet piling as a vertical barrier is not retained.

3.1.2.3.2 *Slurry Walls*

Description: Slurry walls are a common subsurface barrier because they are a relatively inexpensive means of reducing groundwater flow in unconsolidated earth materials. Slurry walls are constructed in a vertical trench that is excavated under a slurry. This slurry, usually a mixture of bentonite and water, acts essentially like a drilling fluid. It hydraulically shores the trench to prevent collapse, and at the same time, forms a filter cake on the trench walls to prevent high fluid losses into the surrounding ground. In some cases, soil or cement are added to the bentonite slurry to form a soil-bentonite or cement-bentonite slurry wall.

Initial Screening: Slurry walls are typically used when they can be "keyed" into a confining layer and the groundwater does not move rapidly. The potential of contaminant migration to the underlying bedrock layer would reduce the effectiveness of a slurry wall as a vertical barrier. Additionally, slurry wall installation generates significant spoils that must be managed and is also difficult to implement adjacent to a wetland/stream system without migration concern. This process option is not retained.

3.1.2.3.3 *Grouting*

Grouting is typically accomplished by drilling a grout tool down to a given depth and then raising up the tool while injecting grout through the jet. The actual grouting injection locations may be at plan intervals close enough to ensure overlap of the known radius of a jet tool, or may be further apart based on the ability of the grout to penetrate undisturbed soils that are beyond the tool radius. This technique can be used to construct a full or partial vertical barrier.

Initial Screening: The process typically results in an excess volume of soils that has to be managed and in most cases disposed of. Also, this process may not be effective in controlling groundwater contaminant migration due to the possibility of contaminant migration to the underlying bedrock layer. Jet grouting is not retained as an option for groundwater.

3.1.2.3.4 Hydraulic Containment

Description: In order to prevent contaminated groundwater from migrating, hydraulic control via the removal of groundwater may be utilized. This technique involves the use of a line of extraction wells or other means (*e.g.*, trench) to pump out site groundwater as it flows toward the site boundary, thus preventing flow off-site. This water would need to be treated and discharged.

Initial Screening: Hydraulic containment relies upon the creation of overlapping capture zones by the pumping of extraction wells to prevent flow past the wells. Poor hydraulic conditions were noted at the Site during the RI; therefore extraction technologies are not considered feasible for site groundwater. Therefore, this process option is not retained.

3.1.2.4 Removal

Groundwater removal technologies involve extraction of contaminated groundwater combined with treatment and disposal. The design of a groundwater extraction system depends upon the depth of contamination and hydrogeologic factors of the aquifer.

3.1.2.4.1 Extraction Wells

Description: Groundwater extraction wells screened within the aquifer utilize a submersible pump set within the screened interval to withdraw contaminated groundwater. Extraction wells are effective when the aquifer characteristics are favorable for a constant recharge of groundwater into the well. They are an efficient way of delivering groundwater to a treatment system, can be utilized for aquifer remediation and can be used for removal in support of a vertical barrier system.

Initial Screening: Poor hydraulic conditions were noted at the Site during the RI such as slow monitoring well recharge effects, and the shallow thickness of the overburden water bearing unit (less than five feet). Extraction technologies are not considered feasible for site groundwater. Therefore, this process option is not retained.

3.1.2.5 In Situ Treatment

3.1.2.5.1 In Situ Permeable Reactive Barrier (PRB)

Description: PRB technology has been proven effective in treating chlorinated contaminants in groundwater. A permeable reactive wall is installed across the flow path of a contaminant plume, allowing the groundwater of the plume to passively move through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others. The contaminants will either be degraded or retained in a concentrated form by the barrier material. Target contaminant groups for passive treatment walls are VOCs, SVOCs, and inorganics.

Initial Screening: The overburden groundwater unit at the Site is relatively shallow in thickness, and a PRB would not likely be effective for this hydrogeologic unit. Although this technology can effectively treat VOCs and inorganics in groundwater, this process option is not retained due to poor site hydraulic conditions.

3.1.2.5.2 In Situ Biodegradation

Description: Biological treatment involves the use of native microbes to degrade a variety of organic compounds. *In situ* biodegradation promotes and accelerates natural processes in the undisturbed subsurface via the addition of appropriate reagents. The applicability of a bioremediation approach is determined by the biodegradability of the organic constituents, and environmental factors affecting microbial activity.

Initial Screening: *In situ* biodegradation is a viable technology for application to impacted groundwater and is effective for remediation of organic constituents. With this process, organic contaminant concentrations in the overburden and bedrock groundwater could be reduced. Therefore, this process option is retained.

3.1.2.5.3 In Situ Chemical Oxidation/Ozonation

Description: This technology involves the use of a chemical reagent that is injected into the groundwater via use of constructed wells or driven wellpoints. The reagent breaks down the organic constituents into carbon dioxide and water. The amount of reagent needed, spacing of injection points, and the frequency of addition to achieve cleanup goals are dependent upon organic constituent concentrations and groundwater flow. Chemical reagents can also be placed within the excavation areas to achieve a limited one-time treatment.

Initial Screening: This treatment technology can be applied to groundwater impacted with organic constituents. Field pilot studies would be necessary to further refine the operational conditions of this technology. This treatment could be applied to both the overburden and bedrock hydrogeologic units. This process option is retained for the contaminated groundwater at the Site.

3.1.2.5.4 In Situ Air Sparging

Description: *In situ* air sparging is a process where air is sparged through well screens into an aquifer by supplying compressed air into the wellhead under controlled conditions. The sparged air enters the aquifer in the form of small bubbles after being broken up while passing through the well screen and into the porous media. The bubbles then rise up through the groundwater and perform diffused air stripping in the aquifer. This process removes VOCs from the groundwater and transfers them into the vapor zone. The vapors must be captured via soil vapor extraction methods in the vadose zone and treated before being discharge to the atmosphere. Pilot testing is required when using this technology. This technology can be utilized at significant depths below the ground surface, is well established, and is effective as long as nonaqueous phase liquids are not present. A support infrastructure must be established and includes utility trenches, air sparging equipment (compressor and controls), soil vapor extraction equipment, and vapor phase treatment equipment, and O&M during operation.

Initial Screening: This technology is effective for VOCs; however, it may not be as effective under the site hydraulic conditions, where overburden groundwater is sometimes absent. However, this process option will be retained for further evaluation.

3.1.2.5.5 In Situ Carbon Adsorption

Description: *In situ* carbon adsorption would involve the installation of granulated activated carbon (GAC) in a trench or cell in a manner so as to intercept groundwater flow. Activated carbon selectively adsorbs constituents in hazardous wastes by a surface attraction phenomenon in which the organic molecules are attracted to the internal pores of the carbon granules. GAC can be used for the adsorption of volatile organics, semivolatile organics, pesticides, and herbicides in groundwater. Adsorption efficiency is chemical specific, depending upon the strength of the molecular attraction between adsorbent and adsorbate, molecular weight, electrokinetic charge, pH, and surface area. Once the micropore surfaces are saturated with organics, the carbon is "spent" and must be replaced with fresh carbon or regenerated. This would be accomplished from the ground surface via manholes.

Initial Screening: Although this technology is effective for VOCs, it would be technically impracticable to implement this technology in the bedrock hydrogeologic unit. Therefore, this technology is not retained as a process option.

3.1.2.6 Ex Situ Treatment

This class of remedial technologies would be applied to groundwater that has been removed from the aquifer (e.g., via extraction wells). Underlying the Site, overburden groundwater is found at shallow depths above bedrock (less than five feet in hydraulic thickness). Slow monitoring well recharge effects seen in the field, seasonally dry monitoring wells and the shallow thickness of the overburden water bearing unit (less than five feet) are signs of low-flow conditions at the Site. Extraction and *ex situ* treatment technologies are not considered feasible for the treatment of contaminated groundwater. Therefore, *ex situ* treatment technologies and process options were not evaluated in this FS.

3.1.3 Sediment

Technologies for the *ex situ* remediation of soil are generally applicable to sediments (after removal). Therefore, the descriptions and initial screening of technologies presented in Section 3.1.1 for soils are also generally valid for sediments. A brief summary of each technology category identifying deviations from the soil screening is provided below, and Table 3-3 summarizes the technology screening for sediments.

3.1.3.1 No Action

The initial screening of No Action for sediment is identical to soil. No Action is retained for comparison of other alternatives.

3.1.3.2 Limited Action

The initial screening of the process options for Limited Action is nearly identical to soil. Physical barriers to restrict access may be more difficult to implement, since access to sediment areas from the water (*i.e.*, off-site) may be possible and also since impacted sediments are located on third-party owned properties; however, these process options were retained for further evaluation.

3.1.3.3 Containment

The initial screening of the process options for containment varies from soil in that capping is not feasible, since it would prevent the maintenance or re-establishment of a healthy ecosystem. Similarly, vertical containment barriers are not considered feasible for containment of contaminated sediment, since they would interfere with the natural sediment ecosystem. However, vertical containment barriers such as sheet piling are retained for sediment excavation purposes. Sheet piling may be used for construction of cofferdams during sediment removal in areas of impacted sediment (*e.g.*, in the unnamed pond).

3.1.3.4 Removal

The initial screening of conventional excavation as discussed in the soil technology screening is applicable for sediments in shallow water or in areas where surface water can be eliminated before removal of sediment (*e.g.*, by diversion or dewatering). For deeper sediment removal, dredging could be implemented; however, due to the shallow nature of the on-site water bodies, it is anticipated that conventional excavation techniques can be utilized to remove sediment, and dredging is therefore not evaluated.

3.1.3.5 In Situ Treatment

The initial screening of *in situ* treatment for sediments varies from soil in that *in situ* treatment is considered not technically feasible in sediment areas due to the difficulty in system installation (e.g., wells), operation (*e.g.*, off-gas collection), and monitoring. Therefore, no *in situ* treatment technologies were retained for sediment alternative development.

3.1.3.6 Ex Situ Treatment

The initial screening of *ex situ* treatment for soil are generally applicable to sediment. The *ex situ* soil treatment technologies described in Section 3.1.1 are applicable to sediments at the Magna Metals Site.

3.1.3.7 Disposal

The initial screening of disposal technologies for sediments is identical to soil.

TABLE 3-3
SCREENING OF SEDIMENT TECHNOLOGIES AND PROCESS OPTIONS

General Response Actions	Remedial Technology Types	Process Options	Technical Feasibility
No Action	No Action	Monitoring and Site Reviews	Retained
Limited Action	Access Restrictions	Access Restrictions	Retained
	Institutional Controls	Environmental Easements	Retained
		Health and Safety Plan and Soil Management Plan	Retained
	Monitoring	Monitoring and Site Reviews	Retained
Containment	Capping	Permeable Soil	Not Retained
		Clay	Not Retained
		Asphalt	Not Retained
		Multi-Media	Not Retained
	Barrier Walls	Sheet Piling	Not Retained
		Slurry Walls	Not Retained
		Grouting	Not Retained
Removal/Treatment/ Disposal	Removal	Excavation	Retained
	In Situ Treatment	Soil Vapor Extraction	Not Retained
		Soil Flushing/Washing	Not Retained
		Stabilization/ Solidification	Not Retained
		Steam stripping (DUS)	Not Retained[1]
		Biodegradation	Not Retained[1]
		Oxidation	Not Retained[1]
	Ex Situ Treatment	Reuse/Recycling	Retained
		Stabilization/ Solidification	Retained
		Thermal Desorption	Not Retained
		Incineration	Not Retained
		Biodegradation	Not Retained
		Soil Flushing/ Washing	Not Retained
		Soil Vapor Extraction	Not Retained
		Chemical Oxidation	Not Retained
	Disposal	On-site Landfill	Not Retained
		Off-site Disposal	Retained

Notes (variations from soil screening):
[1]*In situ* technologies are not considered applicable for sediment.

3.2 Selection of Process Options

Process options are evaluated on the basis of overall remedial effectiveness, technical implementability, and cost relative to site-specific conditions, contaminant types, and contaminant concentrations.

Process option effectiveness focuses on: 1) ability to process the estimated quantities of material and to meet contaminant reduction goals; 2) effectiveness of protecting health and the environment during the construction and implementation phases; and 3) reliability of the technology with respect to contaminants and site conditions.

Implementability refers to how easy it will be to employ the process option based on site and contaminant characteristics.

The cost evaluation is preliminary and relies upon engineering judgment and vendor-provided information to generate a relative cost of process options within a technology type.

The initially screened and accepted soil, groundwater, and sediment process options are evaluated qualitatively based on effectiveness, implementability, and cost as described above. Comparisons are made within each technology type by assessing the effectiveness, implementability and cost of each process option as low, moderate, or high relative to other process options within the technology type. When significant variations between process options within a technology type do not exist, a moderate rating was assigned. Based on this evaluation, specific process options were selected for development of media-specific remedial alternatives. The results of the process option evaluation and selection are summarized in Tables 3-4, 3-5, and 3-6 for soil, groundwater, and sediment respectively.

TABLE 3-4 (Sheet 1 of 2)
SELECTION OF SOIL PROCESS OPTIONS

Process Option	Effectiveness	Implementability	Cost
***No Action**	Does not meet RAOs	Easily implemented	Very low cost
Limited Action			
*Environmental Easements	Prevents exposure to site subsurface contaminants	Easily implemented	Low cost
Access Restrictions	Prevents exposure to site contaminants	Easily implemented	Low cost
*Health and Safety Plan and Site Management Plan	Protects workers during future activities and manages soil	Easily implemented	Low cost
*Monitoring and Site Reviews	Monitors site conditions	Easily implemented	Low cost
Containment			
Permeable Soil Capping	Prevents exposure to site contaminants	Implementable	Low cost
Clay Capping	Prevents exposure to site contaminants and reduces contaminant migration	Implementable	Low cost
Asphalt Capping	Prevents exposure to site contaminants and reduces contaminant migration	Implementable	Moderate cost
Multi-Media Capping	Prevents exposure to site contaminants and reduces contaminant migration	Implementable	Moderate to High cost
Sheet Piling	Does not effectively inhibit migration when pathway to underlying bedrock exists; may be used for dewatering purposes	Implementable	Moderate cost
Removal			
*Excavation	Effective for contaminant removal for subsequent treatment and disposal	Implementable at shallow depths; more complex for deeper contamination	Moderate to High cost, depending on required depth

TABLE 3-4 (Sheet 2 of 2) SELECTION OF SOIL PROCESS OPTIONS			
***In Situ* Treatment**			
In situ stabilization/ solidification	Effective for inorganic constituents	Moderate to difficult to implement, and is equipment intensive	Moderate to high cost
***Ex Situ* Treatment**			
Recycling/Reuse	Effective for the reuse of slightly impacted site soils and other materials	Easily implemented; several options available	Low to moderate cost
Stabilization/ Solidification	Moderately effective for immobilization of free water, site contaminants; no destruction	Easy to implement; must identify disposal location for stabilized contaminants	Moderate cost
Disposal			
*Off-site landfill	Effective for final disposal of treated soil	Easy to implement; requires transportation coordination	Moderate to High cost
*Process options that have been selected for development of remedial alternatives.			

TABLE 3-5 (Sheet 1 of 1)
SELECTION OF GROUNDWATER PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost
*No Action	Does not meet RAOs	Easily implemented	Very low cost
Limited Action			
*Use restrictions	Prevents exposure to contaminants	Easily implemented	Low cost
*Health and Safety Plan	Protects workers during future activities	Easily implemented	Low cost
*Monitored Natural Attenuation	Monitors natural attenuation of groundwater contaminants	Easily implemented	Low to Moderate cost
***In Situ* Treatment**			
In Situ Biodegradation	Destructive treatment for GW contaminants; slow to achieve cleanup goals	Moderately implementable	Moderate cost
**In Situ* Chemical Oxidation	Destructive treatment for GW contaminants; rapidly achieves cleanup goals	Moderately implementable	Moderate cost
*Limited Permanganate Application	Beneficial to enhance restoration of groundwater	Easily implemented (one-time application in conjunction with soil removal)	Low to moderate cost
In Situ Air Sparging	Effective for removal of organic contaminants from groundwater	Moderately implementable	Moderate cost
*Process options selected for development of remedial alternatives.			

TABLE 3-6 (Sheet 1 of 1)
SELECTION OF SEDIMENT PROCESS OPTIONS

Process Option	Effectiveness	Implementability	Cost
***No Action**	Does not meet RAOs	Easily implemented	Very low cost
Limited Action			
*Environmental Easements	Prevents exposure to site contaminants	Easily implemented	Low cost
Access Restrictions	Prevents exposure to site contaminants	Easily implemented	Low cost
*Health and Safety Plan and Site Management Plan	Protects workers during future activities and manages soil	Easily implemented	Low cost
*Monitoring and Site Reviews	Monitors site conditions	Easily implemented	Low cost
Containment			
Sheet Piling	Not effective for contaminent of contaminants; may be used for coffer dam/removal purposes	Implementable	Moderate cost
Grouting	Not effective for contaminent of contaminants; may be used for coffer dam/removal purposes	Implementable	Moderate to High cost
Removal			
*Excavation	Effective for contaminant removal for subsequent treatment and disposal	Easily implemented	Moderate to High cost, depending on required depth and location
***Ex Situ* Treatment**			
Recycling/Reuse	Effective for the reuse of slightly impacted site sediments	Easily implemented; several options available	Low to moderate cost
Stabilization/ Solidification	Moderately effective for immobilization of free water, site contaminants; no destruction	Easy to implement; must identify disposal location for stabilized contaminants	Moderate cost
Disposal			
*Off-site landfill	Effective for final disposal of treated sediments	Easy to implement; requires transportation coordination	Moderate to high cost

*Process options that have been selected for development of remedial alternatives.

3.3 Development of Alternatives

Based on the evaluations discussed in the preceding sections, the following media-specific remedial alternatives were developed for the Magna Metals site:

3.3.1 Soil Alternatives

Inorganics are the primary contaminants to be addressed within the soil media. Therefore, the following alternatives were developed:

- S-1: No Action
- S-2: Limited Action
- S-3: Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Restricted Use SCOs and Building Demolition
- S-4: Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Unrestricted Use SCOs and Building Demolition

3.3.2 Groundwater Alternatives

VOCs and inorganics are the contaminants of concern in groundwater. In addition, sub slab vapor is impacted with VOCs; therefore, mitigation of potential vapor intrusion is also incorporated into the Groundwater Remedial Alternatives. An active remediation alternative for groundwater and passive remediation alternatives (in combination with source removal and including overburden excavation to top of underlying bedrock) have been developed.

- GW-1: No Action
- GW-2: Groundwater Monitoring and Sub Slab Vapor Mitigation
- GW-3: *In Situ* Treatment and Sub Slab Vapor Mitigation
- GW-4: Limited Permanganate Application, Groundwater Monitoring, and Sub Slab Vapor Mitigation

3.3.3 Sediment Alternatives

Inorganics are the predominant contaminants of concern in sediments.

- SD-1: No Action
- SD-2: Limited Action
- SD-3: Removal of Metals-Impacted Sediments
  - SD-3A: Off-Site Removal of Metals – Impacted Sediments above Habitat Assessment Based PRGs
  - SD-3B: Off-Site Removal of Metals – Impacted Sediments above Pre-Release Conditions
  - SD-3C: Off-Site Removal of Metals – Impacted Sediments above NYSDEC LELs

3.4 Preliminary Screening of Alternatives

The next stage in the feasibility evaluation typically consists of a preliminary screening of potential remedial alternatives based on the general criteria of effectiveness, implementability, and cost. The purpose of the screening step is to reduce the number of alternatives requiring further analysis by identifying those alternatives having sufficient merit to undergo detailed evaluation. As a result of the relatively small number of feasible alternatives developed for each media at the site, preliminary screening was not performed; the alternatives identified in the previous section were carried forward for detailed analysis in Section 4.0.

4.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section presents a detailed description and evaluation of the remedial alternatives identified in Section 3.0. Section 4.1 discusses the evaluation criteria against which the remedial actions are analyzed. Section 4.2 presents detailed descriptions of each of the alternatives and the results of the analysis of each alternative with respect to each of the criteria.

4.1 Description of Analysis Criteria

The remedial alternatives developed in Section 4.1 were evaluated using the following seven criteria:

1. Compliance with Standards, Criteria, and Guidance (SCGs);
2. Overall Protection of Human Health and the Environment;
3. Short-Term Impacts and Effectiveness;
4. Long-Term Effectiveness and Permanence;
5. Reduction of Toxicity, Mobility, and/or Volume;
6. Implementability; and
7. Cost.

The seven criteria are described in the following sections.

4.1.1 Compliance with SCGs (as set forth in Section 2.0 of this report)

This criterion is used to determine how each remedial alternative complies with Standards, Criteria and Guidance (SCGs). Each alternative is evaluated in detail for:

- Compliance with chemical-specific SCGs (e.g., Class GA standards);
- Compliance with action-specific SCGs (e.g., RCRA minimum technology standards);
- Compliance with location-specific SCGs (e.g., floodplains); and

4.1.2 Overall Protection of Human Health and the Environment

This criterion provides an overall assessment of protection based on a composite of factors such as long-term and short-term effectiveness and compliance with SCGs. Evaluations of the overall protectiveness address:

- How well a specific site remedial action achieves protection over time;
- How well site risks are reduced; and
- How well each source of contamination is eliminated, reduced, or controlled for each remedial alternative.

4.1.3 Short-Term Impacts and Effectiveness

This criterion addresses the impacts of the action during the construction and implementation phase until the remedial action objectives have been met. Factors evaluated include protection of the community during the remedial actions; protection of workers during the remedial actions;

environmental impacts resulting from the implementation of the remedial actions; and the time required to achieve protection.

4.1.4 Long-Term Effectiveness and Permanence

This criterion addresses the results of the remedial action in terms of the potential risk remaining at the site after the remedial action objectives have been met. The components of this criterion include the magnitude of the residual risks; the adequacy and suitability of controls used to manage treatment residuals or untreated wastes; and the long-term reliability of management controls for providing continued protection from residuals (i.e., the assessment of potential failure of the technical components).

4.1.5 Reduction of Toxicity, Mobility and/or Volume

This criterion addresses the statutory preference that treatment is used to result in the reduction of the total mass of toxic contaminants, the irreversible reduction in contaminant mobility, or the reduction of the total volume of contaminated media. Factors to be evaluated in this criterion include the treatment process employed; the amount of hazardous material destroyed or treated; the degree of reduction in toxicity, mobility or volume expected; and the type and quantity of treatment residuals.

4.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing a remedial action and the availability of various services and materials required during its implementation. *Technical feasibility* factors include construction and operation difficulties; reliability of technology; ease of undertaking additional remedial actions; and the ability to monitor the effectiveness of the remedy. *Administrative feasibility* includes the ability and time required for permit approval and for activities needed to coordinate with other agencies. Factors employed in evaluating the availability of services and materials include availability of treatment, storage, and disposal services with required capacities; availability of equipment and specialists; and availability of prospective technologies for competitive bid.

4.1.7 Cost

The types of costs that would be addressed include: capital costs, operation and maintenance (O&M) costs, costs of periodic reviews (where required), present value of capital and O&M costs, and potential future remedial action costs. Capital costs consist of direct and indirect costs. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Indirect costs include expenditures for engineering, administrative, and other services required to complete the implementation of remedial alternatives. Annual O&M costs include auxiliary materials and energy, disposal of residuals, purchased services, administrative costs, insurance, taxes, license costs, maintenance reserve and contingency funds, rehabilitation costs, and costs for long-term monitoring.

This assessment evaluates the costs of the remedial actions on the basis of present worth. Present worth analysis allows remedial actions to be compared on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A required operating performance period and a discount rate are assumed to calculate present worth cost. A discount rate of five percent is assumed for a base calculation. The discount rate represents the anticipated difference between the rate of investment return and inflation. The estimated costs provided for the remedial actions have an accuracy of -30 to +50 percent as suggested in TAGM 4030.

4.2 Detailed Analysis of Alternatives

The following sections present descriptions of each of the remedial alternatives and the results of the evaluation of the alternatives against the seven criteria defined above.

4.2.1 Detailed Analysis of Soil Remedial Alternatives

This section presents the evaluation of remedial alternatives for soil. As indicated previously, the alternatives incorporate various technologies to address contamination at the Magna Metals Site.

4.2.1.1 Alternative S-1: No Action

The No Action alternative includes no active remediation at the site. Contaminated soils would be left in place with no treatment or controls to prevent future exposure to contaminated media. Periodic reviews would be performed to assess any changes in the risk to health and the environment posed by the site. This alternative is developed as a basis of comparison for other alternatives.

4.2.1.1.1 Compliance with SCGs

The No Action alternative does not comply with chemical-specific SCGs since no action would be taken to address NYSDEC SCO exceedances. Action- and location-specific SCGs are not triggered, since no on-site remedial activities would be performed.

4.2.1.1.2 Overall Protection of Human Health and the Environment

The No Action alternative would not remove, contain, or treat the contaminated soil at the site. Therefore, potential risks to health and the environment resulting from contaminated soil above cleanup levels would remain unchanged. In addition, there is the continued potential for migration of contaminants and potential vapor intrusion into occupied buildings.

4.2.1.1.3 Short-Term Impacts and Effectiveness

Under the No Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. This alternative would not result in any short-term improvement over current conditions. As no design or construction activities are required for this alternative, it would take no time to implement.

4.2.1.1.4 Long-Term Effectiveness and Permanence

The No Action alternative would have low long-term effectiveness and/or permanence. The potential for future exposure to contaminated soil. (e.g., during intrusive construction activities) would not be mitigated. No institutional or engineering controls would be implemented to mitigate potential exposure to the contaminated material.

4.2.1.1.5 Reduction of Mobility, Toxicity, and/or Volume

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated soil or impacted subslab vapor. Therefore, this alternative would not provide any reduction in the toxicity, mobility, and/or volume of contaminants.

4.2.1.1.6 Implementability

There are no technical feasibility concerns with the No Action alternative. The effectiveness of the remedy would be evaluated in periodic reviews and implementation of this alternative would not preclude further remedial action in the future. There are no administrative feasibility concerns with this alternative. As this alternative involves no construction activities, availability of resources and use of proven technologies is not applicable. Consulting services are readily available for periodic reviews. Coordination with regulatory agencies would be required for making decisions regarding any future remedial alternatives.

4.2.1.1.7 Cost

There is no capital cost or annual O&M cost for the No Action alternative.

4.2.1.2 Alternative S-2: Limited Action

The Limited Action alternative includes no active remediation at the site. Contaminated soils would be left in place with no treatment and limited controls to prevent potential future exposure to contaminated media. Under this alternative, environmental easements (on the ISCP property) would be implemented to restrict future use of the site to commercial activities. A HASP and Site Management Plan would be developed and implemented to describe (for example) adequate control measures and PPE/monitoring to be implemented during intrusive activities. Periodic reviews would also be performed to assess changes in the potential risks posed by the Site.

4.2.1.2.1 Compliance with SCGs

The Limited Action alternative does not comply with chemical-specific SCGs since no action would be taken to address NYSDEC SCO exceedances. Action- and location-specific SCGs are not triggered, since no on-site remedial activities would be performed.

4.2.1.2.2 Overall Protection of Human Health and the Environment

The Limited Action alternative would not remove, contain, or treat the contaminated soil. Potential risks from exposure to on-site contaminated subsurface soil above cleanup levels would be mitigated by institutional controls; environmental easements. Proper implementation of the

HASP and Site Management Plan would help mitigate potential future exposure to contaminated soil. However, there is the continued potential for migration of contaminants.

4.2.1.2.3 *Short-Term Impacts and Effectiveness*

Under the Limited Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. Through development and implementation of a HASP, direct contact risks would be minimized. The Site Management Plan would help to mitigate risks. The time required to implement this alternative would be approximately six months.

4.2.1.2.4 *Long-Term Effectiveness and Permanence*

Potential for future exposure at the Site would be mitigated by institutional controls following implementation of this alternative. Limited controls would be implemented to manage the remaining contaminated material such as restricting future use to commercial/industrial, and controlling intrusive activities at the Site. These controls would be effective at mitigating risks on site, though there is the potential for violation of these controls. Risks at the Site would be re-evaluated periodically.

4.2.1.2.5 *Reduction of Mobility, Toxicity, and/or Volume*

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated soil. Therefore, this alternative would not provide any reduction in the toxicity, mobility, and/or volume of contaminants.

4.2.1.2.6 *Implementability*

There are no technical feasibility concerns with the Limited Action alternative for soil. The effectiveness of the remedy would be evaluated in periodic reviews. As this alternative involves no construction activities, availability of resources and use of proven technologies is not a concern. Consulting services are readily available for negotiation and implementation of environmental easements and preparation of a HASP and Site Management Plan. Services are also available for conducting periodic reviews.

4.2.1.2.7 *Cost*

The capital cost associated with negotiation and implementation of the required institutional controls is $39,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $95,000, including periodic reviews. See Appendix A for details.

4.2.1.3 *Alternative S-3: Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Restricted Use SCOs and Building Demolition*

Alternative S-3 would include the removal of COCs in overburden soils to NYSDEC Restricted Use SCOs and demolition of the former Magna Metals building. Overburden on-site subsurface soils exhibiting COC concentrations above NYSDEC SCOs for Protection of Human Health

(Commercial), Protection of Groundwater, and Protection of Ecological Resources would be removed. Removal of off-site surface soils associated with wetland/sediment areas will be included with the sediment remedial alternative and are therefore not included with this alternative. This alternative also does not include removal of COCs in excess of NYSDEC SCOs in off-site soils that are considered background samples (SS-04 and SS-13 through 15).

The footprint and vertical extent of overburden soil removal would be defined by occurrences of COC concentrations in excess of the NYSDEC Restricted Use SCOs determined during remedial design and implementation of remedial activities (endpoint sampling). Figure 4-1 shows the approximate extent of soil removal based on comparisons of RI and Supplemental RI soil analytical data to the relevant SCOs. Vertically, overburden soil removal would extend to approximately 10 to 15 feet bgs (the approximate depth to bedrock). An estimated volume of 7,000 cubic yards (cy) of soil would be removed.

The proposed building to be demolished is also shown on Figure 4-1. Due to the weakened structural nature of the former Magna Metals building, ISCP's consultant was unable to obtain sample data directly below the floor. Therefore, as part of this alternative, NYSDEC has requested that building demolition and post-demolition sampling of subsurface conditions is included. This alternative includes a contingency for the potential removal of hot spots (contaminated soils above NYSDEC Restricted Use SCOs) below the building floor to an extent of approximately 10 to 15 feet bgs. The maximum volume of soil to be removed from beneath the former Magna Metals building is approximately 3,900 cy. This option is contingent upon hot spot soils being present below the building slab.

An added benefit of soil excavation is that contaminated groundwater within the excavation boundaries is removed. Shoring and/or sheet piling may be needed for this alternative for slope stability and safety, as well as for dewatering purposes since the excavation proceeds below the water table; however, as discussed previously, significant quantities of groundwater are not anticipated due to site hydraulic conditions. Dewatering and removal of the contaminated overburden soil material will have the added benefit of locally addressing groundwater contamination.

Prior to backfilling the excavation area, an application of permanganate, which is considered to be part of groundwater alternative GW-4, could be performed at the bottom of the excavation area for the purpose of treating residual contamination located within underlying bedrock fractures (see Alternative GW-4). Following the one-time application of the permanganate in implementation of GW-4, the excavation area would be backfilled.

Excavated soils may be reused as backfill if all compounds are below regulatory criteria. For the purposes of this FS, it is assumed that clean backfill will replace all areas where soil is removed. Post-remediation confirmatory sampling is included as part of this alternative in areas where soil will be removed. Post-remediation sampling will be performed to ensure that remedial action objectives have been met.

Options for treatment and disposal of excavated soil could include reuse/recycling, on- or off-site stabilization/solidification, or on- or off-site chemical reduction/oxidation. For the purposes of this FS, off-site landfill disposal at an appropriate facility was considered. During remedial design, market conditions will be re-evaluated to assess the cost-effectiveness of alternative treatment options, facilities, or technologies.

Environmental easements would be implemented to restrict future use of the Site. A HASP and Site Management Plan would be developed and implemented to describe (for example) adequate control measures and PPE/monitoring to be implemented during on-site intrusive activities. Periodic reviews would also be performed to assess changes in the potential for human exposure and impacts to the environment posed by the Site.

4.2.1.3.1 Compliance with SCGs

Restricted Use SCOs would be achieved for COCs through excavation. Construction activities would be conducted in accordance with action- and location-specific SCGs. Wastes generated would be managed, transported, and treated in accordance with applicable local, State, and Federal requirements.

4.2.1.3.2 Overall Protection of Human Health and the Environment

Removal of contaminated overburden soil to Restricted Use SCOs in conjunction with restricting future use of the Site would be protective of human health and the environment. By removing the sources of contamination, the potential for continued contaminant migration to groundwater would be reduced to the maximum extent practicable. Furthermore, removal of saturated overburden soils would remove impacted groundwater.

4.2.1.3.3 Short-Term Impacts and Effectiveness

This alternative would involve extensive on-site remedial activities to remove contaminated soils and the former Magna Metals building. There would be risks typically associated with construction activities, including movement of heavy equipment across an active facility. A HASP would be developed and implemented to provide protection for on-site workers. In addition, appropriate engineering controls (*i.e.*, water sprays, excavation in an enclosed structure, etc.) may be necessary to mitigate the possibility of fugitive dust, etc. Off-site transportation would be performed in strict accordance with transportation plans to minimize impacts to neighborhoods through which contaminated soil will be transported. Development of a Site Management Plan would help to mitigate potential exposures. The timeframe required for implementation of this alternative is approximately 6 to 12 months.

4.2.1.3.4 Long-Term Effectiveness and Permanence

This alternative would be effective and permanent over the long-term. Limited controls would be implemented to manage remaining contamination above NYSDEC Unrestricted Use SCOs, consisting of restricting future use to commercial activities. The site remedy would be evaluated periodically.

4.2.1.3.5 Reduction of Mobility, Toxicity, and/or Volume

Removal of COCs in overburden soil and source areas would significantly reduce the potential for exposure and migration of contaminants. Treatment at the off-site disposal facility would substantially reduce the toxicity and/or volume of contaminated soil. Copper and nickel were selected for mass reduction analysis, as these two contaminants are frequently detected. Based on the average concentration of metals in soil samples within the excavation area (excluding leach pit samples), it is estimated that approximately 6,000 lbs of copper contamination and 1,000 lbs of nickel contamination will be removed by excavation activities associated with this alternative.

4.2.1.3.6 Implementability

Technical Feasibility: There are no major technical feasibility concerns with this alternative. Demolition, excavation, transportation, and disposal are conventional technologies that are typically easy to implement. Excavation is not anticipated to extend below approximately 15 feet bgs; therefore, significant technical challenges are not anticipated and conventional equipment can be used. Subsurface structures (*i.e.*, leach pits, septic tanks, and PVC piping) would be removed prior to soil excavation. Based on historic information, subsurface utilities are not present within the excavation area; however, a utility mark-out is required before any intrusive activities. Dewatering using well points outside the excavation area may be required. Any water encountered during excavation would be treated for discharge or off-site disposal, depending on quantity to be managed.

Administrative Feasibility: Administratively, this alternative would be relatively easy to implement. An acceptable transportation plan for the large quantities of soil that would need to be transported to an appropriate disposal facility would be established. Coordination with local authorities would be required to establish an acceptable transportation plan for transportation of material to the site. Coordination with regulatory agencies would also be required for periodic reviews. However, there are no concerns with the ability or time required to interact with local and regulatory agencies.

Availability of Services and Materials: Equipment, labor, and materials are readily available for all components of this alternative. Consulting services are readily available for implementation of the HASP. Services are also available for conducting periodic reviews.

4.2.1.3.7 Cost

The estimated capital cost associated with this alternative is \$3,696,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is \$3,752,000, including periodic reviews.

4.2.1.4 Alternative S-4: Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Unrestricted Use SCOs and Building Demolition

Alternative S-4 would removal of COCs in site soils to meet NYSDEC Unrestricted Use SCOs and demolition of the former Magna Metals building. Evaluation of this alternative is a requirement as per NYSDEC's DER-10. This alternative would not include removal of off-site soils associated with background samples (SS-04 and SS-13 through 15), nor would it include removal of surface soils associated with wetland/sediment areas.

Vertically, soil would be removed to the identified depth of contamination exceeding Unrestricted Use SCOs within the excavation area. The footprint and vertical extent would be defined during remedial design and implementation of remedial activities (endpoint sampling). Figure 4-2 shows the former building area to be demolished and the extent of soil removal based on comparisons of RI and Supplemental RI soil analytical data to NYSDEC Unrestricted Use SCOs. Based on the known footprint depicted in Figure 4-2 and a vertical extent of COC concentrations in excess of NYSDEC Unrestricted Use SCOs (approximately 14 feet), an estimated volume of 7,800 cy of soil would be removed.

The depth of the water table is approximately 10 feet bgs in the vicinity of the remedial area. Shoring and/or sheet piling may be needed for this alternative for slope stability and safety, as well as for dewatering purposes since the excavation proceeds below the water table; however, as discussed previously, significant quantities of groundwater are not anticipated to be encountered due to site conditions. Dewatering and removal of the contaminated overburden soil material will have the added benefit of addressing groundwater contamination.

Excavated soils may be reused as backfill if below regulatory criteria. For the purposes of this FS, it is assumed that clean backfill will replace all areas where soil is removed. Post-remediation confirmatory sampling is included as part of this alternative in areas where soil will be removed. Post-remediation sampling will be performed to ensure that remedial design objectives have been met.

This alternative could be implemented in conjunction with groundwater alternative GW-4, a one-time application of permanganate to the top of the bedrock surface (see Alternative GW-4), while the excavation is open, and prior to backfilling.

Options for treatment and disposal of excavated soil could include reuse/recycling, on- or off-site stabilization/solidification, or on- or off-site chemical reduction/oxidation. For the purposes of this FS, off-site landfill disposal at an appropriate facility was considered. During remedial design, market conditions will be re-evaluated to assess the cost-effectiveness of alternative treatment options, facilities, or technologies.

4.2.1.4.1 Compliance with SCGs

This alternative would be implemented in accordance with chemical-, action-, and location-specific SCGs. This alternative would achieve Unrestricted Use SCOs for COCs. Wastes generated would be managed, transported, and treated in accordance with applicable local, State, and Federal requirements.

4.2.1.4.2 Overall Protection of Human Health and the Environment

This alternative would remove contaminated media and source areas to the maximum extent practicable, providing the maximum protection for human health and the environment.

4.2.1.4.3 Short-Term Impacts and Effectiveness

This alternative would involve extensive on-site remedial activities to remove COCs exceeding Unrestricted Use SCOs and demolition of former Magna Metals building. There would be risks typically associated with construction activities, including movement of heavy equipment through areas adjacent to roads and residential properties. A HASP would be developed and implemented to provide protection for on-site workers. The timeframe required for implementation of this alternative is approximately 6 to 12 months.

4.2.1.4.4 Long-Term Effectiveness and Permanence

This alternative would be effective and permanent over the long-term, as the maximum removal of contaminated materials is performed under this alternative.

4.2.1.4.5 Reduction of Mobility, Toxicity, and/or Volume

Removal of COCs exceeding Unrestricted Use SCOs from the Site would eliminate the potential for exposure and migration of site-related impacts. Treatment at the off-site disposal facility could potentially reduce the mobility, toxicity and/or volume of impacted soil. Copper and nickel were selected for mass reduction analysis as these two contaminants were frequently detected. Based on the average concentration of metals in soil samples within the excavation area (excluding leach pit samples), it is estimated that approximately 6,400 lbs of copper contamination and 1,100 lbs of nickel contamination will be removed by excavation activities associated with this alternative.

4.2.1.4.6 Implementability

Technical Feasibility: Demolition, excavation, transportation, and disposal are conventional technologies that are typically easy to implement. For technical practicability reasons, excavation would not extend below bedrock (maximum depth of approximately 15 feet bgs); therefore, technical challenges are not anticipated and conventional equipment can be used. Subsurface structures (*i.e.*, leach pits and septic tanks) would be removed prior to soil excavation. Based on historic information, subsurface utilities are not present within the excavation area; however, a utility mark-out is required before any intrusive activities. Dewatering using well points outside the excavation area may be required. Any water encountered during excavation would be treated for discharge or off-site disposal, depending on quantity to be managed.

Administrative Feasibility: Administratively, this alternative would be relatively easy to implement. An acceptable transportation plan for the large quantities of soil that would need to be transported to an appropriate disposal facility would be established. Coordination with local authorities would be required to establish an acceptable transportation plan for transportation of material to the site. However, there are no concerns with the ability or time required to interact with local and regulatory agencies.

Availability of Services and Materials: Equipment, labor, and materials are readily available for all components of this alternative. Consulting services are readily available for implementation of the HASP.

4.2.1.4.7 Cost

The estimated capital cost associated with this alternative is $3,907,000. There is no annual O&M cost associated with this alternative. See Appendix A for details.

4.2.2 Detailed Analysis of Groundwater Remedial Alternatives

This section presents the evaluation of remedial alternatives for groundwater contamination present at the Site.

4.2.2.1 Alternative GW-1: No Action

The No Action alternative includes no active remediation at the site. Contaminated groundwater would be left in place with no treatment or controls to prevent future exposure to contaminated media or further contaminant migration. No mitigation of sub slab VOC impacts would be implemented. However, periodic reviews would be performed to assess changes in the risks posed by the Site.

4.2.2.1.1 Compliance with SCGs

The No Action alternative for groundwater does not comply with SCGs or address sub slab VOC impacts. Groundwater currently exceeds Class GA standards on-site. Groundwater would continue to exceed these criteria for an extended period of time. Natural processes could potentially reduce the contaminant levels to below relevant criteria. Sub slab VOCs would not be actively mitigated. Location- and action-specific SCGs would not be triggered, since no remedial activities would be performed.

4.2.2.1.2 Overall Protection of Human Health and the Environment

This alternative would not include removal, on-site containment, or treatment of contaminated groundwater or address sub slab VOC impacts. Currently, groundwater is not used at the property, so there are no current exposures to contaminated groundwater. However, there are no current restrictions on groundwater usage at the property.

4.2.2.1.3 Short-Term Impacts and Effectiveness

Under the No Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative.

4.2.2.1.4 *Long-Term Effectiveness and Permanence*

Although naturally occurring processes may provide reduction in risks (based on results from remedial investigations) in the long-term, an indefinite timeframe would be required for contaminated groundwater to reach acceptable levels. No controls would be implemented to mitigate potential future exposure to contaminated groundwater.

4.2.2.1.5 *Reduction of Mobility, Toxicity, and/or Volume*

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated groundwater. Therefore, this alternative would not result in any immediate reduction in the toxicity, mobility, or volume of contaminants. Over time, contaminant concentrations in the groundwater may eventually decline to be in compliance with Class GA standards resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase plume volume.

4.2.2.1.6 *Implementability*

There are no technical feasibility concerns with the No Action alternative. The effectiveness of the remedy would be evaluated in periodic reviews and implementation of this alternative would not preclude further remedial action in the future.

4.2.2.1.7 *Cost*

There is no capital cost or annual O&M cost for the No Action alternative.

4.2.2.2 *Alternative GW-2: Groundwater Monitoring and Sub Slab Vapor Mitigation*

This alternative includes monitoring of groundwater, institutional controls to mitigate potential future exposure pathways at the Site, in conjunction with the removal of contaminated soil (overburden aquifer material) during implementation of either Alternatives S-3 or S-4, and installation of a sub slab vapor depressurization system. Groundwater use restrictions would be implemented to prohibit use of groundwater. Figure 4-3 summarizes Alternative GW-2.

Sample data from 1998, 2004, and 2006 reports consistently showed that the source of the groundwater contamination was the former leach pits. Although there are currently exceedances of NYSDEC Class GA Levels, this alternative is being considered since addressing the sources of contamination will likely mitigate the zone of where contaminated groundwater is present through direct removal of the overburden material that constitutes the water bearing zone at the Site. Furthermore, the results of various groundwater sampling events between 1997 and 2006 have shown reductions in concentrations of VOCs in groundwater and have also shown the possibility of a natural dechlorination process occurring at the Site. Evidence of dechlorination, in addition to removal of the overburden soil material, supports selection of the monitoring alternative for groundwater.

This alternative would include institutional controls to prohibit the use of groundwater for potable purposes on-site or in the adjacent community.

As part of the remedial design for this alternative, a monitoring program would be developed, and data would be collected to verify ongoing reduction of remaining groundwater contamination. Both new and existing monitoring wells would be incorporated within the monitoring network.

Sub Slab Vapor

Elevated levels of VOCs were primarily detected in sub-slab samples from below the Polymedco Office/Laboratory during the RI phase. Indoor Air Quality testing indicated normal results. In order to reduce the potential for soil vapor intrusion, a Sub Slab Depressurization System (SSD) is included in Alternative GW-2.

An SSD system will be installed beneath approximately 18,000 square feet of floor slab of the Polymedco Office/Laboratory, as shown on Figure 4-3. The proposed system will consist of one or more fans or blowers, which draw air from the soil beneath the building, and a series of collection and discharge pipes. As part of the proposed SSD system, the floor slab of the Polymedco Office/Laboratory will need to be sealed off from the system (i.e., no cracks, gaps, etc. in the slab). After system start-up, if pressure testing indicates a negative pressure field has not been established, the SSD system will be expanded.

For purposes of FS costing and analysis, it is anticipated that one of the following SSD units will be required:

- Low Pressure/High Flow – used where permeable soils exist sub slab - the unit typically consists of an in-line centrifugal fan and 4-inch diameter PVC piping.
- High Pressure/Low Flow – used where lower permeability soils exist sub slab - the unit typically consists of a regenerative blower and 1.5 to 2-inch diameter PVC piping.

Structures such as underground piping or footings beneath the Polymedco building may impede air flow, and therefore, will be carefully considered. Additionally, depth to bedrock may be in close proximity to the building sub slab. The specific details and selection of the system will be identified during remedial design.

In addition, a HASP would be developed and implemented at the former ISCP property to ensure use of adequate control measures and PPE during intrusive activities. Periodic reviews would also be performed to assess changes in the risk to human health and the environment posed by the Site.

4.2.2.2.1 Compliance with SCGs

Implementation of Alternative GW-2 would be performed in compliance with action- and location-specific SCGs and monitors chemical-specific SCGs. Implementation of S-3 and S-4 will significantly reduce impacts to groundwater on their own.

4.2.2.2.2 *Overall Protection of Human Health and the Environment*

Alternative GW-2 by itself would not fully remove, contain, or treat the contaminated groundwater. Risks associated with the potential for ingestion of contaminated groundwater and/or dermal contact with contaminated groundwater would be greatly reduced by implementation of use restrictions. Inhalation of vapor would be mitigated by the sub slab vapor system. Selection of Soil Alternative S-3 or S-4 would remove contaminated groundwater within the excavation boundaries during dewatering activities.

4.2.2.2.3 *Short-Term Impacts and Effectiveness*

Limited construction would be involved in this alternative. Additional monitoring wells may need to be installed to complete the monitoring network. Any contaminants existing outside the soil removal areas would persist at the Site. It is estimated that this alternative could be implemented in less than 6 to 12 months.

4.2.2.2.4 *Long-Term Effectiveness and Permanence*

It is anticipated that natural processes will at some time in the future achieve target cleanup levels (NYSDEC WQ Values) for organic COCs in groundwater. Maintenance of groundwater use restrictions will mitigate potential exposures.

4.2.2.2.5 *Reduction of Mobility, Toxicity, and/or Volume*

This alternative by itself would not involve any containment, removal, treatment, or disposal of the contaminated groundwater. Therefore, this alternative would not result in any immediate reduction in the toxicity, mobility, or volume of contaminants in groundwater. Over time, organic contaminant concentrations in the groundwater may eventually decline to be in compliance with Class GA standards resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase plume volume. Furthermore, implementation of soil Alternative S-3 or S-4 would have a significant reduction of mobility, toxicity, and/or volume of both organic and inorganic contamination in groundwater; therefore, making GW-2 a viable alternative.

4.2.2.2.6 *Implementability*

There are no technical feasibility concerns with Alternative GW-2 for groundwater. The effectiveness of the remedy would be evaluated in periodic reviews.

As this alternative involves limited construction activities, resources and proven technologies are readily available. Consulting services are also readily available for negotiation and implementation of use restrictions, monitoring, and O&M of the sub slab system. Services are also available for conducting periodic reviews. Coordination with regulatory agencies would be required for review of groundwater data and periodic reviews as well as making decisions regarding any future remedial alternatives.

4.2.2.2.7 Cost

A capital cost of $250,000 is estimated for implementation of the monitoring network, sub slab vapor mitigation, and groundwater use restrictions. Annual O&M cost is estimated to be $40,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $927,000, including costs for periodic reviews.

4.2.2.3 Alternative GW-3: In Situ Treatment and Sub Slab Vapor Mitigation

4.2.2.3.1 Description

This alternative provides for *in situ* treatment of contaminated groundwater to significantly reduce or eliminate residual contaminants in groundwater, and installation of a sub slab vapor depressurization system. For development of this alternative, several *in situ* treatments are carried through, such as *in situ* chemical oxidation, *in situ* biodegradation, and *in situ* air sparging. Remedial design activities may potentially use one of these process options or a combination for incorporation into the remedial design.

In situ chemical oxidation would be performed by injection of a chemical reagent (e.g., fenton's reagent) into the subsurface through injection points located on-site. *In situ* chemical oxidation could be effective for organic contaminants in groundwater. The amount of reagent needed, spacing of injection points, injection point requirements, and the frequency of addition to achieve cleanup goals would be determined during pre-design investigation activities.

In situ biodegradation would be effective for organic contaminants in groundwater and would include the addition of oxygen to the saturated zone to enhance the performance of microbial activity in the subsurface. Oxygen may be added via either an oxygen releasing compound or controlled direct injection of air or oxygen itself. *In situ* biodegradation may require a longer implementation schedule than *in situ* chemical oxidation due to the possible need for multiple rounds of injections. Details, such as the numbers of injection points and schedule for biodegradation activities would be addressed during pre-design investigation activities.

In situ air sparging would include injecting air below the contaminated area to partition the dissolved, sorbed, or any free-phase VOCs (if present) into the vapor phase. The vapors would be captured via soil vapor extraction methods in the vadose zone and treated before being discharge to the atmosphere. Extreme care will be exercised so that contaminants are removed efficiently and without adverse effects, such as the spread of residual VOCs to clean areas. *In situ* air sparging may require a longer implementation schedule than *in situ* chemical oxidation due to the continuous nature of the process. Details, such as the numbers of injection points and schedule for sparging activities would be addressed during pre-design investigation activities.

Monitoring wells, located downgradient of the injection locations, would be used to monitor the treated groundwater. The location and requirements of downgradient monitoring wells would be determined during design activities.

Sub Slab Vapor

The Sub Slab Depressurization System described in Alternative GW-2 would also be included in Alternative GW-3.

4.2.2.3.2 Compliance with SCGs

This alternative would reduce or eliminate concentrations of contaminants in groundwater to comply with Class GA standards. Depending on the type of treatment process selected, residual concentrations of inorganics in groundwater are possible. Activities associated with this alternative would be performed in accordance with applicable location and action-specific SCGs.

4.2.2.3.3 Overall Protection of Human Health and the Environment

In situ treatment would break down contaminants in the groundwater to achieve the Class GA standards. Ultimately, the breakdown of contaminants in groundwater would be protective of human health and the environment. However, there are significant uncertainties with respect to time to remediate. Conservatively, ultimate restoration would be in terms of decades, not years. Since there are currently exceedances of Class GA standards, well use restrictions would be maintained. Potential for inhalation of vapor would be mitigated by the sub slab vapor system.

4.2.2.3.4 Short-Term Effectiveness

The installation of the injection wells would cause minimal disturbance. These activities will be performed in accordance with safe construction practices and a HASP to ensure that workers and the public are not impacted by subsurface contamination disturbed during these activities. The installation of the *in situ* groundwater treatment system is anticipated to require approximately 3 months. Operation depends on the selected treatment process and may be for a period of 1 to 2 years after completion of the source remedies. In the event of extended dry periods, treatment duration may require a longer period of time.

4.2.2.3.5 Long-Term Effectiveness and Permanence

This alternative, in conjunction with a remedy for source soils, may ultimately achieve Class GA standards. Until the standards are achieved, water use restrictions will remain in place to ensure protection of human health. Upon reaching the groundwater standards, the groundwater remedy would be permanent to the extent that source remedies are permanent (or maintained) to prevent recontamination of groundwater leaving the Site.

4.2.2.3.6 Reduction of Mobility, Toxicity, or Volume

This alternative would involve *in situ* treatment of contaminated groundwater. The toxicity of groundwater would be reduced by the treatment or removal of contaminants. In addition, the system has the effect of minimizing mobility by treating groundwater before it leaves the Site.

4.2.2.3.7 Implementability

Technical Feasibility: The installation of injection points and operation of an *in situ* treatment system can be readily implemented using conventional technologies. However, due to the limited aquifer depth and availability of water and limited hydraulic conductivities, any active *in situ* treatment will be extremely difficult, and leaves the duration to achieve Class GA standards in doubt.

Administrative Feasibility: Environmental easements would have to be implemented and maintained.

Availability of Services and Materials: Materials and services for installation and operation of the *in situ* chemical oxidation system and O&M of the sub slab system are readily available.

4.2.2.3.8 Cost

The capital cost for this alternative is estimated at $1,490,000. Annual O&M cost is estimated to be $40,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $2,167,000. See Appendix A for more information.

4.2.2.4 Alternative GW-4: Limited Permanganate Treatment, Groundwater Monitoring, and Sub Slab Vapor Mitigation

4.2.2.4.1 Description

This alternative provides for a single, one-time application of permanganate within the soil excavation area in conjunction with alternatives S-3 or S-4. This alternative also includes groundwater monitoring and installation of a sub slab vapor depressurization system.

Prior to backfilling the excavation, permanganate would be applied at the bottom of the excavation area for the purpose of oxidizing residual groundwater contamination located within underlying bedrock. The concentration and volume of permanganate would be determined during pre-design investigation activities. Permanganate would enter the bedrock through any existing cracks or fissures such as fractures. For the purposes of this FS, it is assumed that approximately 1,000 gallons of permanganate would be added. Following the one-time application of the permanganate, the excavation area would be backfilled.

Monitoring wells, located downgradient of the treatment area, would be used to monitor the treated groundwater. The location and requirements of downgradient monitoring wells would be determined during design activities.

Sub Slab Vapor

The Sub Slab Depressurization System described in Alternative GW-2 would also be included Alternative GW-4.

4.2.2.4.2 Compliance with SCGs

Combined with the selected soil excavation alternative, this alternative would reduce or eliminate residual concentrations of contaminants in groundwater. Residual concentrations of inorganics in groundwater are possible. Activities associated with this alternative would be performed in accordance with applicable location and action-specific SCGs.

4.2.2.4.3 Overall Protection of Human Health and the Environment

The application of permanganate would oxidize organic contaminants in the groundwater to enhance restoration to Class GA standards. Ultimately, the breakdown of contaminants in groundwater would be protective of human health and the environment. However, there are significant uncertainties with respect to time to remediate. Conservatively, ultimate restoration would be in terms of decades, not years. Well use restrictions would be maintained. Potential for inhalation of vapor would be mitigated by the sub slab vapor system.

4.2.2.4.4 Short-Term Effectiveness

The application of permanganate would cause little or no disturbance beyond the disturbance created by the excavation activities. Activities will be performed in accordance with safe construction practices and a HASP to ensure that workers and the public are not impacted during these activities. The application of permanganate would take place immediately following excavation activities and prior to backfilling.

4.2.2.4.5 Long-Term Effectiveness and Permanence

This alternative, in conjunction with a soil excavation, may ultimately achieve Class GA standards. Until the standards are achieved, water use restrictions will remain in place to ensure protection of human health. Upon reaching the groundwater standards, the groundwater remedy would be permanent.

4.2.2.4.6 Reduction of Mobility, Toxicity, or Volume

This alternative would involve oxidation of contaminated groundwater largely in bedrock in combination with the selected soil alternative. The toxicity of groundwater would be reduced by the oxidation. In addition, the volume of contaminated groundwater (specifically overburden) will be reduced as a result of the removal of contaminants in groundwater during dewatering activities associated with soil removal.

4.2.2.4.7 Implementability

Technical Feasibility: The application of permanganate, groundwater monitoring, and a sub slab vapor system can be readily implemented using conventional technologies.

Administrative Feasibility: Environmental easements would have to be implemented and maintained.

Availability of Services and Materials: Materials and services for addition of permanganate, groundwater monitoring, and O&M of the sub slab system are readily available.

4.2.2.4.8 Cost

The capital cost for this alternative is estimated at $377,000. Annual O&M cost is estimated to be $40,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $1,054,000. See Appendix A for more information.

4.2.3 Detailed Analysis of Sediment Remedial Alternatives

This section presents the evaluation of remedial alternatives for sediment. The alternatives incorporate various technologies to address impacted sediment on the Magna Metals Site.

4.2.3.1 Alternative SD-1: No Action

The No Action alternative includes no active remediation at the site. Contaminated sediments would be left in place with no treatment or controls to prevent future exposure to contaminated media. Periodic reviews would be performed to assess any changes in the risk to the environment posed by the site. This alternative is developed as a basis of comparison for other alternatives.

4.2.3.1.1 Compliance with SCGs

The No Action alternative does not comply with chemical-specific SCGs since no action would be taken to address contaminated sediment. Action- and location-specific SCGs are not triggered, since no on-site remedial activities would be performed.

4.2.3.1.2 Overall Protection of Human Health and the Environment

The No Action alternative would not remove, contain, or treat the contaminated sediment. Therefore, potential ecological risks resulting from contaminated sediment above cleanup levels would remain unchanged. Risks associated with the potential for direct contact with contaminated sediment would persist. In addition, there is the continued potential for migration of contaminants.

4.2.3.1.3 Short-Term Impacts and Effectiveness

Under the No Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. This alternative would not result in any short-term improvement over current conditions. As no design or construction activities are required for this alternative, it would take no time to implement.

4.2.3.1.4 *Long-Term Effectiveness and Permanence*

The No Action alternative would have no long-term effectiveness and/or permanence. The magnitude of risks would be the same following implementation of this alternative. No institutional controls would be implemented to manage the contaminated sediments.

4.2.3.1.5 *Reduction of Mobility, Toxicity, and/or Volume*

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated sediments. Therefore, this alternative would not provide any reduction in the toxicity, mobility, and/or volume of contaminants.

4.2.3.1.6 *Implementability*

There are no technical feasibility concerns with the No Action alternative. The effectiveness of the remedy would be evaluated during periodic reviews and implementation of this alternative would not preclude further remedial action in the future.

There are no administrative feasibility concerns with this alternative. As this alternative involves no construction activities, availability of resources and use of proven technologies is not applicable. Consulting services are readily available for periodic reviews. Coordination with regulatory agencies would be required for making decisions regarding any future remedial alternatives.

4.2.3.1.7 *Cost*

There is no capital cost or annual O&M cost for the No Action alternative.

4.2.3.2 *Alternative SD-2: Limited Action*

The Limited Action alternative includes no active remediation at the site. Contaminated sediments would be left in place with no treatment and limited controls to prevent future exposure to contaminated media. Under this alternative, a HASP and Site Management Plan would be developed and implemented to describe (for example) adequate control measures and PPE/monitoring to be implemented during intrusive activities. Periodic reviews would also be performed to assess changes in the potential risk to human health and the environment posed by the Site.

4.2.3.2.1 *Compliance with SCGs*

The Limited Action alternative does not comply with chemical-specific SCGs since no action would be taken to address contaminated sediment. Action- and location-specific SCGs are not triggered, since no on-site remedial activities would be performed.

4.2.3.2.2 *Overall Protection of Human Health and the Environment*

The Limited Action alternative would not remove, contain, or treat the contaminated sediment. Risks resulting from contaminated sediment above cleanup levels would be somewhat mitigated by institutional controls (e.g., proper implementation of the HASP and Site Management Plan). However, ecological risks would not be mitigated, and there is the continued potential for exposure.

4.2.3.2.3 Short-Term Impacts and Effectiveness

Under the Limited Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. Development and implementation of a HASP and Site Management Plan would help to mitigate risks. The time required to implement this alternative would be approximately six months.

4.2.3.2.4 Long-Term Effectiveness and Permanence

Potential risks would be mitigated by institutional controls. These controls would be effective at mitigating risks to human health, though there is the potential for violation of these controls. Risks at the Site would be re-evaluated periodically. Risks to ecological resources would not be mitigated under this alternative.

4.2.3.2.5 Reduction of Mobility, Toxicity, and/or Volume

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated sediment. Therefore, this alternative would not provide any reduction in the toxicity, mobility, and/or volume of contaminants.

4.2.3.2.6 Implementability

There are no technical feasibility concerns with the Limited Action alternative for sediment. The effectiveness of the remedy would be evaluated in periodic reviews. As this alternative involves no construction activities, availability of resources and use of proven technologies is not a concern. Institutional controls may be difficult to implement since the affected area is off-site, on private property. Consulting services are readily available for negotiation and implementation of access restrictions and HASP and Site Management Plan. Services are also available for conducting periodic reviews.

4.2.3.2.7 Cost

The capital cost associated with negotiation and implementation of the required institutional controls is $39,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $95,000, including periodic reviews. See Appendix A for details.

4.2.3.6 Alternative SD-3A: Removal of Metals-Impacted Sediments Above Habitat-Assessment Based PRGs

Alternative SD-3A would include the removal of sediments with contaminant concentrations above the PRGs developed during the Habitat assessment (as part of the RI). For the purposes of this FS, sediments have been grouped into two separate areas (referred to as "sediment systems") based on location and the areas of concern established in the Habitat Assessment. The first is the Furnace Brook/Unnamed Pond sediment system; the second is the Unnamed Tributary System. The locations of Furnace Brook, the Unnamed Pond, and the Unnamed Tributary can be seen on sediment figures in Section 2.0 of this report.

This alternative would involve removal of sediments from the Furnace Brook/Unnamed Pond sediment system with concentrations of nickel and copper above 200 mg/kg and 415 mg/kg, respectively (PRGs established during the RI), and sediments from the Unnamed Tributary sediment system with concentrations of nickel and copper above 143 mg/kg and 107 mg/kg, respectively (PRGs).

In addition, COCs in excess of NYSDEC Ecological SCOs will be removed from off-site surface soils in the locations of SS-06 through 10. Surface soils in these wetland locations are included with this sediment alternative. The approximate areas of sediments and surface soils to be removed under this alternative can be seen in Figure 4-4A.

Confirmatory sampling during the implementation of this alternative will assess the impact of vertical contamination. For FS estimating purposes, materials will be removed to a depth of approximately two feet bgs and replaced with comparable materials to pre-existing grade to re-establish the sediment ecosystem. Two feet are selected as a matter of standard practice. As part of the remedial design, an investigation will be performed to confirm actual depths. In addition, post excavation sampling will be performed following remediation.

The quantity of off-site sediment and surface soil to be removed and replaced under this alternative is approximately 3,840 CY. Excavated wetland substrate will be restored with similar clean material, matching the organic content to existing. In the submerged aquatic excavation areas, clean sand or similar will be used. All excavation areas will be revegetated in kind through replanting and reseeding, Wetlands and aquatic environments will be restored to original contours, ensuring little to no change in drainage patterns and ensuring re-establishment of vegetation.

Options for treatment and disposal of excavated sediment could include reuse/recycling, on- or off-site stabilization/solidification, or on- or off-site chemical or thermal treatment. Treatment and disposal of excavated sediments/soils will correspond with treatment and disposals of excavated soils. For the purposes of this FS, off-site landfill disposal at an appropriate facility was considered. During remedial design, market conditions will be re-evaluated to assess the cost-effectiveness of alternative treatment options, facilities, or technologies.

Also included in this alternative are institutional controls, consisting of use restrictions, and development and implementation of a HASP and Site Management Plan. Periodic reviews would also be performed to assess any changes in the risk to health and the environment posed by the Site.

This alternative also includes post-remedial monitoring of surface water to monitor the effectiveness of sediment remediation on surface water. Furnace Brook, the unnamed pond, and the unnamed tributary would be sampled biannually and compared to regulatory criteria. Surface water data would be included in periodic site reviews.

4.2.3.6.1 *Compliance with SCGs*

This alternative will comply with chemical-specific SCGs as determined by the habitat assessment-based PRGs. Removal and restoration activities would be performed in accordance with all applicable action- and location-specific SCGs. Mitigation of wetlands would also be performed as required based on the disturbed wetlands within the sediment system areas.

4.2.3.6.2 *Overall Protection of Human Health and the Environment*

This alternative would provide protection through the removal of contaminated sediment. Residual contamination above unrestricted use criteria may remain after implementation of this alternative. Potential exposure to residual contamination will be mitigated by institutional controls.

4.2.3.6.3 *Short-Term Impacts and Effectiveness*

This alternative would involve off-site construction to remove contaminated sediment and surface soils. There would be risk of exposure to contaminants that are mobilized during these activities. There would also be risks typically associated with construction activities, including movement of heavy equipment. These risks would be addressed by developing and implementing a HASP to provide protection for workers. In addition, appropriate engineering controls (*i.e.*, controlling access, controlling transport of contaminants to surface water bodies, etc.) would be needed. The timeframe required for implementation of this alternative is approximately 6 to 12 months.

4.2.3.6.4 *Long-Term Effectiveness and Permanence*

This alternative would potentially result in attainment of target cleanup levels upon completion of the remedial activities. This alternative removes contaminated sediment and surface soils to reduce exposure risks. Residual risks, if any, would be mitigated by institutional controls. Otherwise, no institutional controls are anticipated.

4.2.3.6.5 *Reduction of Mobility, Toxicity, and/or Volume*

Removal of off-site contaminated sediments and surface soils would significantly reduce the potential for migration of contaminants and potential for exposure. Treatment at the off-site disposal facility could potentially reduce the mobility, toxicity and/or volume of contaminated sediment.

4.2.3.6.6 *Implementability*

Technical Feasibility: There are no major technical feasibility concerns with this alternative. Excavation, transportation, and disposal are conventional remedial technologies that are typically easy to implement. Since sediments are the result of on-site erosion and off-site deposition events, excavation is unlikely to extend below two feet bgs. Therefore, technical challenges are not anticipated and conventional equipment can be used. Restoration can also be easily implemented at the Site.

Administrative Feasibility: Administratively, this alternative could be moderately difficult to implement. Coordination with local authorities would be required to establish an acceptable transportation plan for transportation of material from the site to an appropriate disposal facility. Wetland mitigation would also be required. Access agreements to off-site impacted areas on private properties would also be required for access to the areas proposed for remediation. Multiple third party owners are likely to be included.

Availability of Services and Materials: Equipment, labor, and materials are readily available for all constructional components of this alternative. Materials and services for restoration are generally available; however, custom sediment material may need to be developed and manufactured to replace the sediment material removed.

4.2.3.6.7 Cost

The estimated capital cost associated with this alternative and implementation of the institutional controls, if required, is $1,427,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $1,815,000, including periodic reviews. See Appendix A for details.

4.2.3.7 Alternative SD-3B: Removal of Metals-Impacted Sediments to Pre-Release (Background) Conditions

Alternative SD-3B would include the removal of sediments with analytical concentrations above pre-release (background) PRGs as requested by NYSDEC. The average concentrations of nickel, copper, and zinc from background sediment sample locations SD-27 through SD-31 were used as pre-release PRGs. The average background concentrations of nickel, copper, and zinc from these locations are 24.1, 13.7, and 54.1 mg/kg respectively. Sediment will be removed from off-site areas in locations exceeding these conditions,

In addition, COCs in excess of NYSDEC Restricted Use SCOs will be removed from off-site surface soils in the locations of SS-06 through 10. Surface soils in these wetland locations are included with this alternative. The approximate areas of sediments and surface soils to be removed under this alternative can be seen in Figure 4-4B.

Under Alternative SD-3B, material will be removed from the excavation areas to a depth of approximately two feet and replaced with material comparable to native conditions. Depths may be modified during remediation through sampling. The approximate areas of removal for this alternative can be seen in Figure 4-4B. Two feet are selected as a matter of standard practice. As part of the remedial design, an investigation will be performed to confirm actual depths. In addition, post excavation sampling will be performed following remediation.

The quantity to be removed and replaced under this alternative is approximately 16,000 CY. Excavated wetland substrate will be restored with similar clean material, matching the organic content to existing. In the submerged aquatic excavation areas, clean sand or similar will be used. All excavation areas will be revegetated in kind through replanting and reseeding, Wetlands and aquatic environments will be restored to original contours, ensuring little to no change in drainage patterns and ensuring re-establishment of vegetation.

Options for treatment and disposal of excavated sediment could include reuse/recycling, on- or off-site stabilization/solidification, or on- or off-site chemical or thermal treatment. Treatment and disposal of excavated sediments/soils will correspond with treatment and disposals of excavated soils. For the purposes of this FS, off-site landfill disposal at an appropriate facility was considered. During remedial design, market conditions will be re-evaluated to assess the cost-effectiveness of alternative treatment options, facilities, or technologies.

This alternative also includes post-remedial monitoring of surface water as described in Alternative SD-3A.

Also included in this alternative are institutional controls, consisting of use restrictions, and development and implementation of a HASP and Site Management Plan. Periodic reviews would also be performed to assess any changes in the risk posed by the Site.

4.2.3.7.1 Compliance with SCGs

This alternative will comply with chemical-specific SCGs. Removal and restoration activities would be performed in accordance with applicable action- and location-specific SCGs. Mitigation of wetlands would also be performed as required based on the disturbed wetlands within the sediment system areas.

4.2.3.7.2 Overall Protection of Human Health and the Environment

This alternative would provide protection predominantly through the removal of contaminated sediment and surface soils. Residual contamination in subsurface soil, if any, would be mitigated by institutional controls.

4.2.3.7.3 Short-Term Impacts and Effectiveness

This alternative would involve an on-site construction effort to remove contaminated sediment and surface soils. There would be risk of exposure to contaminants that are mobilized during these activities. There would also be risks typically associated with construction activities, including movement of heavy equipment. These risks would be addressed by developing and implementing a HASP to provide protection for workers. In addition, appropriate engineering controls (*i.e.*, controlling access, controlling transport of contaminants to surface water bodies, etc.) would be needed. The timeframe required for implementation of this alternative is approximately 12 to 18 months.

4.2.3.7.4 Long-Term Effectiveness and Permanence

This alternative would potentially result in attainment of target cleanup levels upon completion of the remedial activities. This alternative is protective of human health and the environment in that it removes contaminated sediment and surface soil to reduce exposure risks.

4.2.3.7.5 *Reduction of Mobility, Toxicity, and/or Volume*

Removal and disposal of contaminated sediments and surface soils would significantly reduce the potential for migration of contaminants. Treatment at the off-site disposal facility could potentially reduce the mobility, toxicity and/or volume of contaminated sediment.

4.2.3.7.6 *Implementability*

Technical Feasibility: There are technical feasibility concerns with this alternative. Excavation, transportation, and disposal are conventional remedial technologies that are typically easy to implement. Excavation is not likely to extend below two feet bgs; therefore, technical challenges are not anticipated and conventional equipment can be used. However, significant degradation of the existing wooded wetland system is likely to occur, resulting from the expansive excavation footprint created by attaining Pre-Release levels. Trees would have to be worked around and/or removed. Native habitats would be destroyed. Extensive wetland restoration would be required.

Administrative Feasibility: Administratively, this alternative could be very difficult to implement. Coordination with local property owners would be required to access private property and also significant disturbance to private properties could occur. Also, local authorities would be required to establish an acceptable transportation plan for transportation of material from the site to an appropriate disposal facility.

Availability of Services and Materials: Equipment, labor, and materials are readily available for all constructional components of this alternative. Materials and services for restoration are generally available; however, custom sediment material may need to be developed and manufactured to replace the sediment material removed.

4.2.3.7.7 *Cost*

The estimated capital cost associated with this alternative and implementation of the required institutional controls is $5,079,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $5,467,000, including periodic reviews. See Appendix A for details.

4.2.3.8 *Alternative SD-3C: Removal of Metals-Impacted Sediments to NYSDEC Lowest Effect Levels (LELs)*

As requested by NYSDEC, Alternative SD-3C includes the removal of sediments with analytical results above NYSDEC Lowest Effect Levels (LELs) for inorganic COCs in sediment. NYSDEC Sediment Cleanup Criteria Lowest Effect Level (LEL) for both nickel and copper is 16 mg/kg. The NYSDEC LEL for zinc is 120 mg/kg. Sediment locations with analytical results of nickel, copper, and zinc exceeding LEL criteria will be removed from the off-site areas as part of this alternative.

In addition, COCs in excess of NYSDEC Ecological SCOs will be removed from off-site surface soils in the locations of SS-06 through 10. Surface soils in these locations are associated with wetlands/sediments and are therefore included with this alternative. The approximate areas of sediments and surface soils to be removed under this alternative can be seen in Figure 4-4C.

Materials will be removed to a depth of approximately two feet. The quantity of sediment to be removed and replaced under this alternative is approximately 15,900 CY. Excavated wetland substrate will be restored with similar clean material, matching the organic content to existing. In the submerged aquatic excavation areas, clean sand or similar will be used. All excavation areas will be revegetated in kind through replanting and reseeding, Wetlands and aquatic environments will be restored to original contours, ensuring little to no change in drainage patterns and ensuring re-establishment of vegetation. Actual depths will be confirmed during remediation through sampling.

Options for treatment and disposal of excavated sediment could include reuse/recycling, on- or off-site stabilization/solidification, or on- or off-site chemical or thermal treatment. Treatment and disposal of excavated sediments/soils will correspond with treatment and disposals of excavated soils. For the purposes of this FS, off-site landfill disposal at an appropriate facility was considered. During remedial design, market conditions will be re-evaluated to assess the cost-effectiveness of alternative treatment options, facilities, or technologies.

This alternative also includes post-remedial monitoring of surface water as described in Alternative SD-3A.

Also included in this alternative are institutional controls, consisting of use restrictions, and development and implementation of a HASP and Site Management Plan. Periodic reviews would also be performed to assess any changes in the risk to human health and the environment posed by the Site.

4.2.3.8.1 Compliance with SCGs

This alternative will comply with chemical-specific SCGs. Removal and restoration activities would be performed in accordance with applicable action- and location-specific SCGs. Mitigation of wetlands would also be performed as required based on the disturbed wetlands within the sediment system areas.

4.2.3.8.2 Overall Protection of Human Health and the Environment

This alternative would provide protection through the removal of contaminated materials to prevent contact and migration. Residual contamination in subsurface soil, if any, would be mitigated by institutional controls.

4.2.3.8.3 Short-Term Impacts and Effectiveness

This alternative would involve a significant construction effort to remove contaminated materials. There would be risk of exposure to contaminants that are mobilized during these activities. There would also be risks typically associated with construction activities, including movement of heavy equipment. These risks would be addressed by developing and implementing a HASP to provide protection for workers. In addition, appropriate engineering controls (*i.e.*, controlling access, controlling transport of contaminants to surface water bodies, etc.) would be needed. The timeframe required for implementation of this alternative is approximately 12 to 18 months.

4.2.3.8.4 Long-Term Effectiveness and Permanence

This alternative would potentially result in attainment of target cleanup levels upon completion of the remedial activities. This alternative is protective in that it removes contaminated sediment and surface soil to reduce exposure risks.

4.2.3.8.5 Reduction of Mobility, Toxicity, and/or Volume

Removal and disposal of contaminated materials would significantly reduce the potential for migration of contaminants and potential for exposure. Treatment at the off-site disposal facility could potentially reduce the mobility, toxicity and/or volume of contaminated sediment.

4.2.3.8.6 Implementability

Technical Feasibility: There are no major technical feasibility concerns with this alternative. Excavation, transportation, and disposal are conventional remedial technologies that are typically easy to implement. Excavation is unlikely to extend below two feet bgs; therefore, technical challenges are not anticipated and conventional equipment can be used. Wetland mitigation would also be required due to the major removal impact imposed on the existing wetland system. Extensive degradation of the native flora and fauna would occur. Extensive numbers of trees would have to be worked around or removed. Native habitats would be destroyed over an extensive area.

Administrative Feasibility: Administratively, this alternative could be very difficult to implement. Coordination with local property owners would be required to access private property and also significant disturbance to private properties could occur. Also, local authorities would be required to establish an acceptable transportation plan for transportation of material from the site to an appropriate disposal facility.

Availability of Services and Materials: Equipment, labor, and materials are readily available for all constructional components of this alternative. Materials and services for restoration are generally available; however, custom sediment material may need to be developed and manufactured to replace the sediment material removed.

4.2.3.8.7 Cost

The estimated capital cost associated with this alternative and implementation of the required institutional controls is $5,048,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $5,436,000, including periodic reviews. See Appendix A for details.

LEGEND

- SB-07 ● SUBSURFACE SOIL BORING SAMPLE LOCATION
- SS-15 ■ SURFACE SOIL BORING SAMPLE LOCATION
- LP-03 ▼ LEACH PIT LOCATION
- MW-02 ⊕ MONITORING WELL LOCATION
- ST-01 ▼ SEPTIC TANK LOCATION
- APPROXIMATE EXCAVATION AREA
- SUBSURFACE SOIL AREA TO BE EXCAVATED (CONTINGENT UPON ANALYTICAL DATA OBTAINED FOLLOWING THE FORMER MAGNA METALS BUILDING DEMOLITION)
- 320 CONTOUR LINE (20 FT INTERVAL)
- APPROXIMATE REFUSE AREA
- APPROXIMATE WETLAND AREA

NOTES:
1. SAMPLE LOCATIONS AND PIT/TANK LOCATIONS ARE APPROXIMATE.
2. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.
3. EXCAVATION AREAS TO BE DETERMINED IN THE FIELD BASED ON CONFIRMATORY SAMPLE RESULTS.
4. EXCAVATED SOILS TO BE REPLACED WITH CLEAN FILL, TOPSOIL, AND SEEDING.
5. COC – CONTAMINANT OF CONCERN
6. SCO – SOIL CLEANUP OBJECTIVE

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.
2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.
3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.
5. TOPOGRAPHIC LINES ARE APPROXIMATE.

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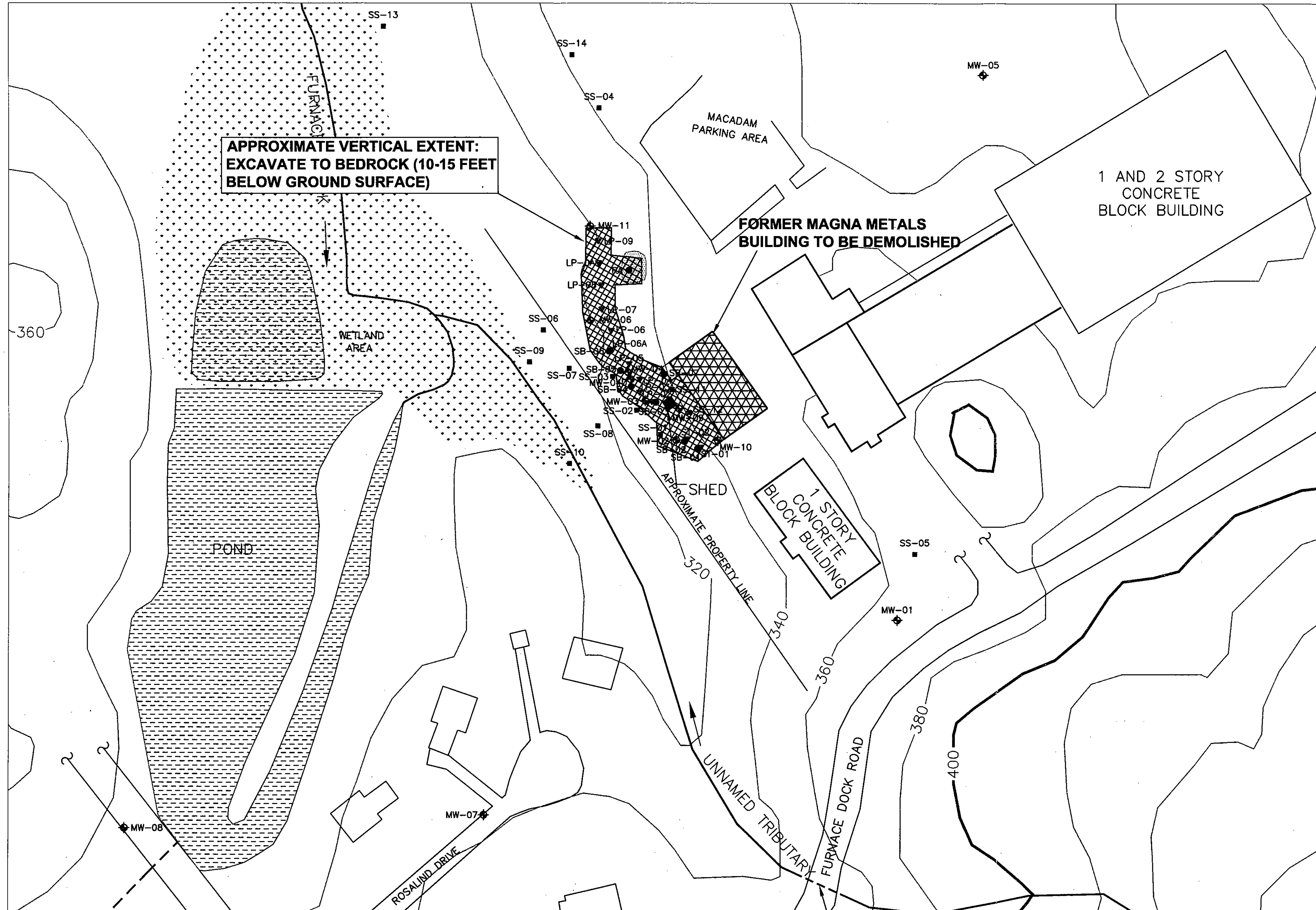

TETRA TECH EC, INC.	TITLE: Alternative S-3: Removal of COCs in Soil Exhibiting Concentration in Excess of NYSDEC Restricted Use SCOs and Building Demolition Magna Metals Cortlandt, New York	DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
		CHKD:	APPD:	FIGURE NO.: 4-1
		DATE: 11/18/09	REV.: 0	

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LEGEND

SB-07 ● SUBSURFACE SOIL BORING SAMPLE LOCATION

SS-15 ■ SURFACE SOIL BORING SAMPLE LOCATION

LP-03 ▼ LEACH PIT LOCATION

MW-02 ⊕ MONITORING WELL LOCATION

ST-01 ▼ SEPTIC TANK LOCATION

APPROXIMATE EXCAVATION AREA

SUBSURFACE SOIL AREA TO BE EXCAVATED (CONTINGENT UPON ANALYTICAL DATA OBTAINED FOLLOWING THE FORMER MAGNA METALS BUILDING DEMOLITION)

——320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTES:

1. SAMPLE LOCATIONS AND PIT/TANK LOCATIONS ARE APPROXIMATE.

2. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.

3. EXCAVATION AREAS TO BE DETERMINED IN THE FIELD BASED ON CONFIRMATORY SAMPLE RESULTS.

4. EXCAVATED SOILS TO BE REPLACED WITH CLEAN FILL, TOPSOIL, AND SEEDING.

5. COC – CONTAMINANT OF CONCERN

6. SCO – SOIL CLEANUP OBJECTIVE

SOURCES:

1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.

2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.

3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.

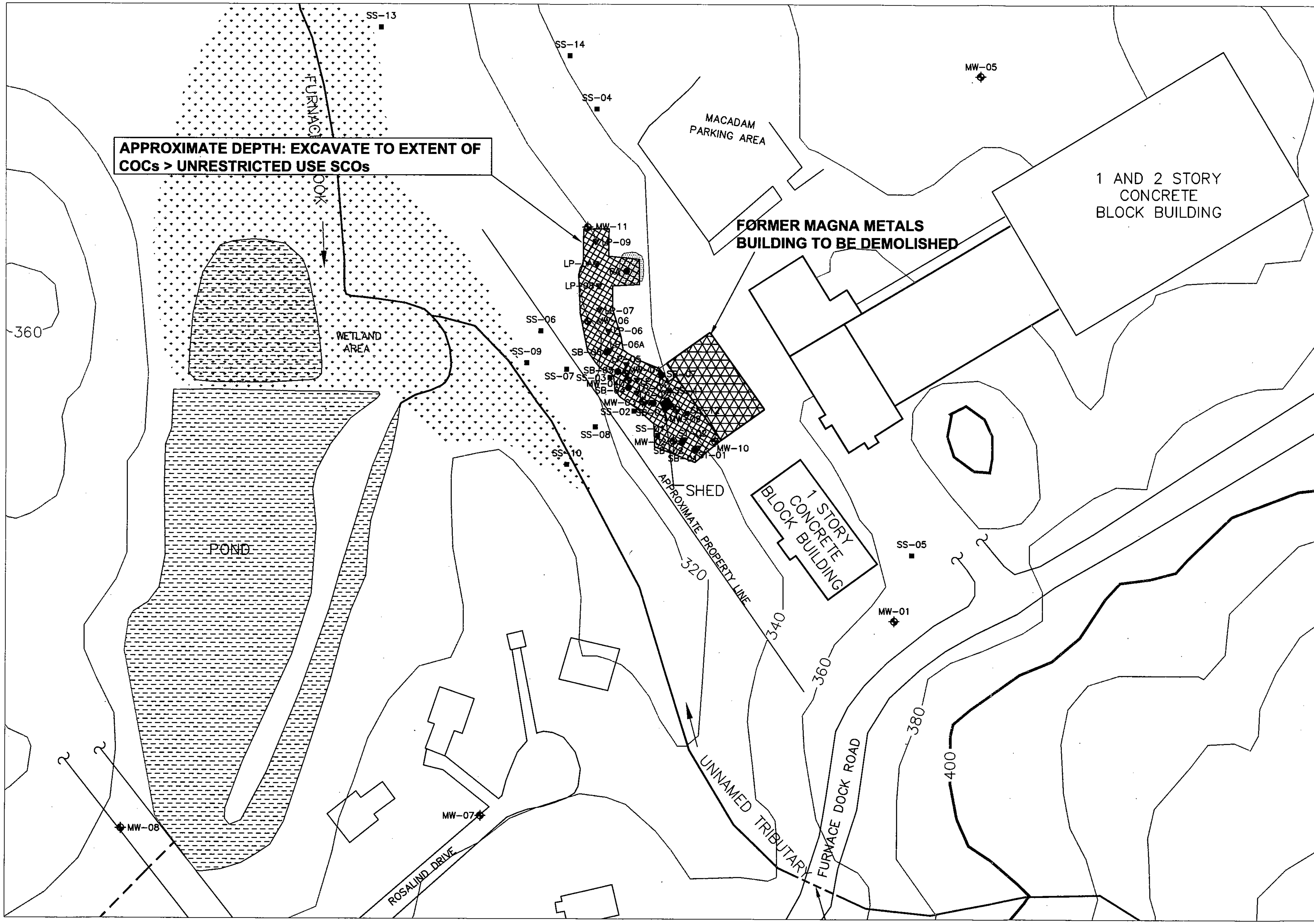
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.

5. TOPOGRAPHIC LINES ARE APPROXIMATE.

0 60 120

FEET

N



TETRA TECH EC, INC.	TITLE: Alternative S-4: Removal of COCs in Soil Exhibiting Concentration in Excess of NYSDEC Unrestricted Use SCOs and Building Demolition Magna Metals Cortlandt, New York	DWN: LMC CHKD: DATE: 11/18/09	DES.: EAG APPD: REV.: 0	PROJECT NO.: 106-1172 FIGURE NO.: 4-2

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 4-2 ALTERNATIVE S-4 111809.DWG

BCLP04246

LEGEND

MW-02 GROUNDWATER SAMPLE LOCATION

MW-12 POSSIBLE NEW MONITORING WELL LOCATION (TO BE VERIFIED DURING REMEDIAL DESIGN)

ALTERNATIVE S-3 AND S-4 REMOVALS

POTENTIAL AREA OF CONTAMINANTS OF CONCERN IN GROUNDWATER ABOVE NYSDEC CLASS GA LEVELS

320 CONTOUR LINE (20 FT INTERVAL)

APPROXIMATE SOURCE AREA

SUB-SLAB DEPRESSURIZATION SYSTEM LOCATION

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTE:
LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, GEOPHYSICAL SURVEY AREA, AND MONITORING WELLS ARE BASED ON SURVEY DATA.

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.

2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.

3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.

4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.

5. TOPOGRAPHIC LINES ARE APPROXIMATE.

0 60 120
FEET

N

TITLE:
ALTERNATIVE GW-2: GROUNDWATER MONITORING AND SUB-SLAB VAPOR MITIGATION
Magna Metals
Cortlandt, New York

TETRA TECH EC, INC.

DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
CHKD: EAG	APPD:	FIGURE NO.: 4-3
DATE: 11/18/09	REV.: 0	

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 4-3 ALTERNATIVE GW-2 111809.DWG

BCLP04247

LEGEND

SD-18 ◆ SEDIMENT SAMPLE LOCATION

SS-06 ◆ SURFACE SOIL SAMPLE LOCATION

—— 320 CONTOUR LINE (20 FT INTERVAL)

POND

APPROXIMATE AREA TO BE REMOVED

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.
2. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.
3. SAMPLE LOCATION FOR SD-13 IS BASED ON GPS COORDINATES.
4. SEDIMENTS AND SURFACE SOILS TO BE REMOVED TO APPROXIMATELY 2 FT. BGS AND FILLED WITH LIKE MATERIAL.
5. PRG – PRELIMINARY REMEDIATION GOAL.

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.
2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.
3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.
5. TOPOGRAPHIC LINES ARE APPROXIMATE.

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FEET

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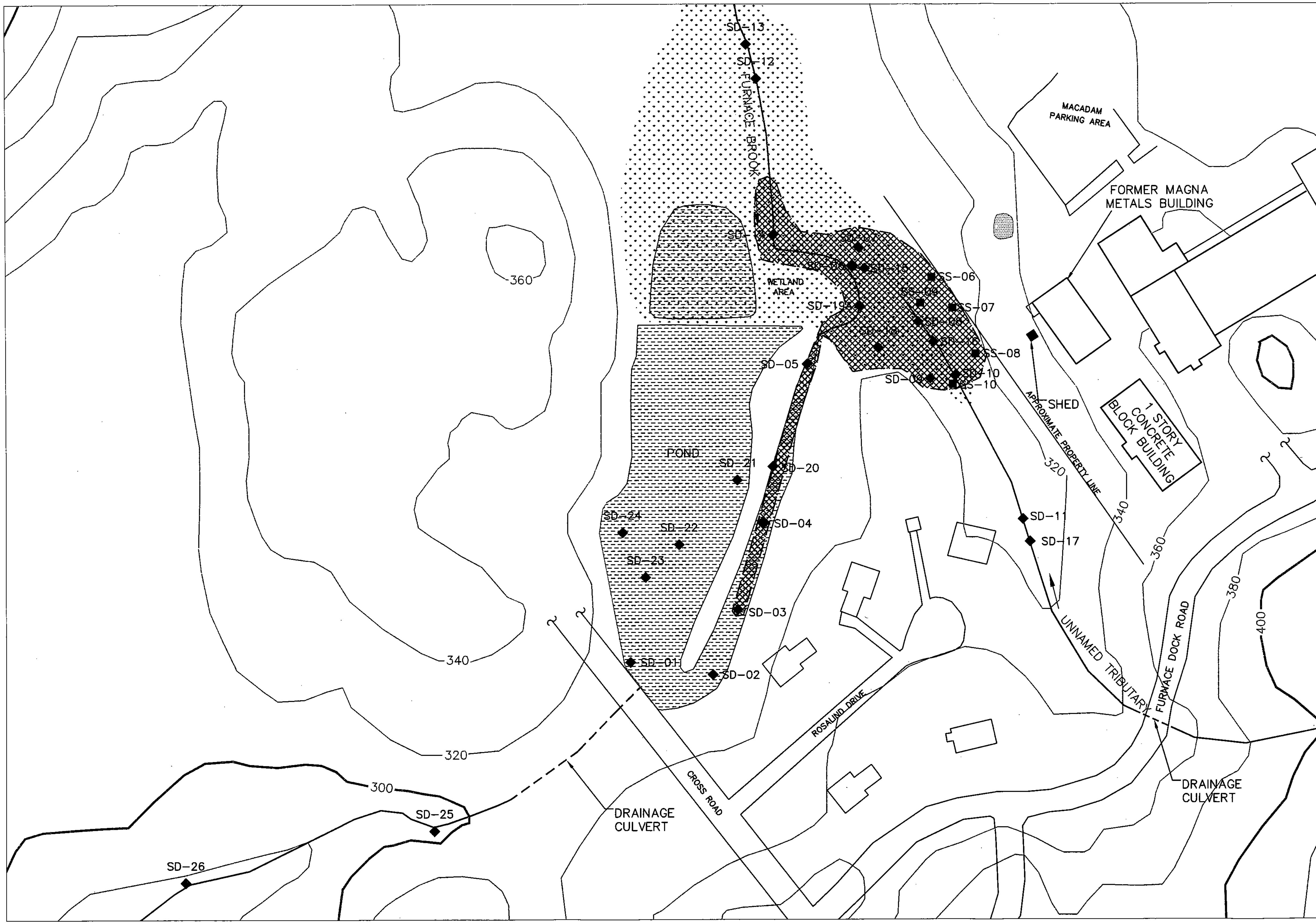


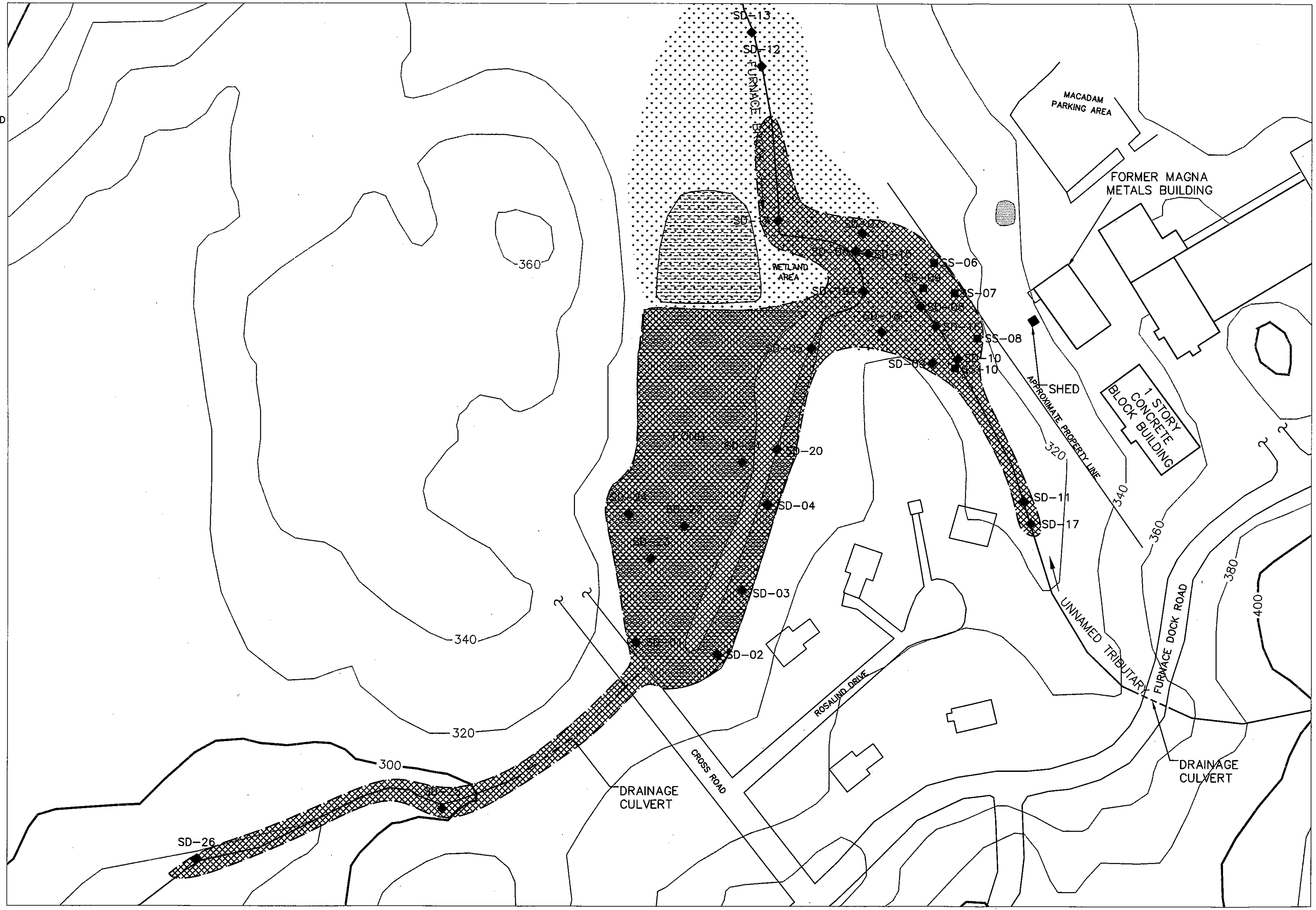
TETRA TECH EC, INC.	TITLE: Alternative SD-3A: Off-Site Removal of Metals – Impacted Sediments Above Habitat Assessment-Based PRGs Magna Metals Cortlandt, New York	DWN: LMC CHKD: DATE: 12/10/09	DES.: EAG APPD: REV.: 0

PROJECT NO.: 106-1172

FIGURE NO.: 4-4A

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 4-4A SEDS ABOVE PRGS 121009.DWG

BCLP04248



LEGEND

SD-18 ◆ SEDIMENT SAMPLE LOCATION

SS-06 ◆ SURFACE SOIL SAMPLE LOCATION

—— 320 CONTOUR LINE (20 FT INTERVAL)

POND

APPROXIMATE AREA TO BE REMOVED

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.
2. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.
3. SAMPLE LOCATION FOR SD-13 IS BASED ON GPS COORDINATES.
4. SEDIMENTS AND SURFACE SOILS TO BE REMOVED TO APPROXIMATELY 2 FT. BGS AND FILLED WITH LIKE MATERIAL.

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.
2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.
3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.
5. TOPOGRAPHIC LINES ARE APPROXIMATE.

0 75 150
FEET

N

TETRA TECH EC, INC.	TITLE: Alternative SD-3B: Off-Site Removal of Metals – Impacted Sediments Above Pre-Release Conditions Magna Metals Cortlandt, New York	DWN: LMC DES.: EAG CHKD: APPD: DATE: 12/03/09 REV.: 0	PROJECT NO.: 106-1172 FIGURE NO.: 4-4B

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 4-4B SEDS ABOVE PRE-RELEASE 120309.DWG

BCLP04249

LEGEND

SD-18 ◆ SEDIMENT SAMPLE LOCATION

SS-06 ◆ SURFACE SOIL SAMPLE LOCATION

—— 320 CONTOUR LINE (20 FT INTERVAL)

POND

APPROXIMATE AREA TO BE REMOVED

APPROXIMATE REFUSE AREA

APPROXIMATE WETLAND AREA

NOTES:
1. SAMPLE LOCATIONS FOR SD-01 TO SD-12 ARE APPROXIMATE.
2. LOCATIONS OF FORMER MAGNA METALS BUILDING, 1 STORY CONCRETE BLOCK BUILDING, SHED, AND GEOPHYSICAL SURVEY AREA ARE BASED ON SURVEY DATA.
3. SAMPLE LOCATION FOR SD-13 IS BASED ON GPS COORDINATES.
4. SEDIMENTS AND SURFACE SOILS TO BE REMOVED TO APPROXIMATELY 2 FT. BGS AND FILLED WITH LIKE MATERIAL.
5. NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION.
6. LEL – LOWEST EFFECT LEVEL.

SOURCES:
1. CONTOUR LINES, FURNACE DOCK ROAD, AND FURNACE BROOK BELOW POND BASED ON MOHEGAN LAKE, NY AND PEEKSKILL, NY TOPOGRAPHIC QUADRANGLES, 7.5-MINUTE SERIES, DATED 1956 AND 1957, RESPECTIVELY, AND PHOTOREVISED IN 1981.
2. ADDITIONAL SURFACE FEATURES BASED ON WESTCHESTER COUNTY DEPARTMENT OF PLANNING AERIAL PHOTOGRAPH (SPRING 1990), DECEMBER 18, 1999 AERIAL PHOTOGRAPH, AND SURVEY DATA.
3. APPROXIMATE REFUSE AREA BASED ON NYSDEC DRAWING.
4. APPROXIMATE WETLAND AREA BASED ON FIELD OBSERVATIONS.
5. TOPOGRAPHIC LINES ARE APPROXIMATE.

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FEET
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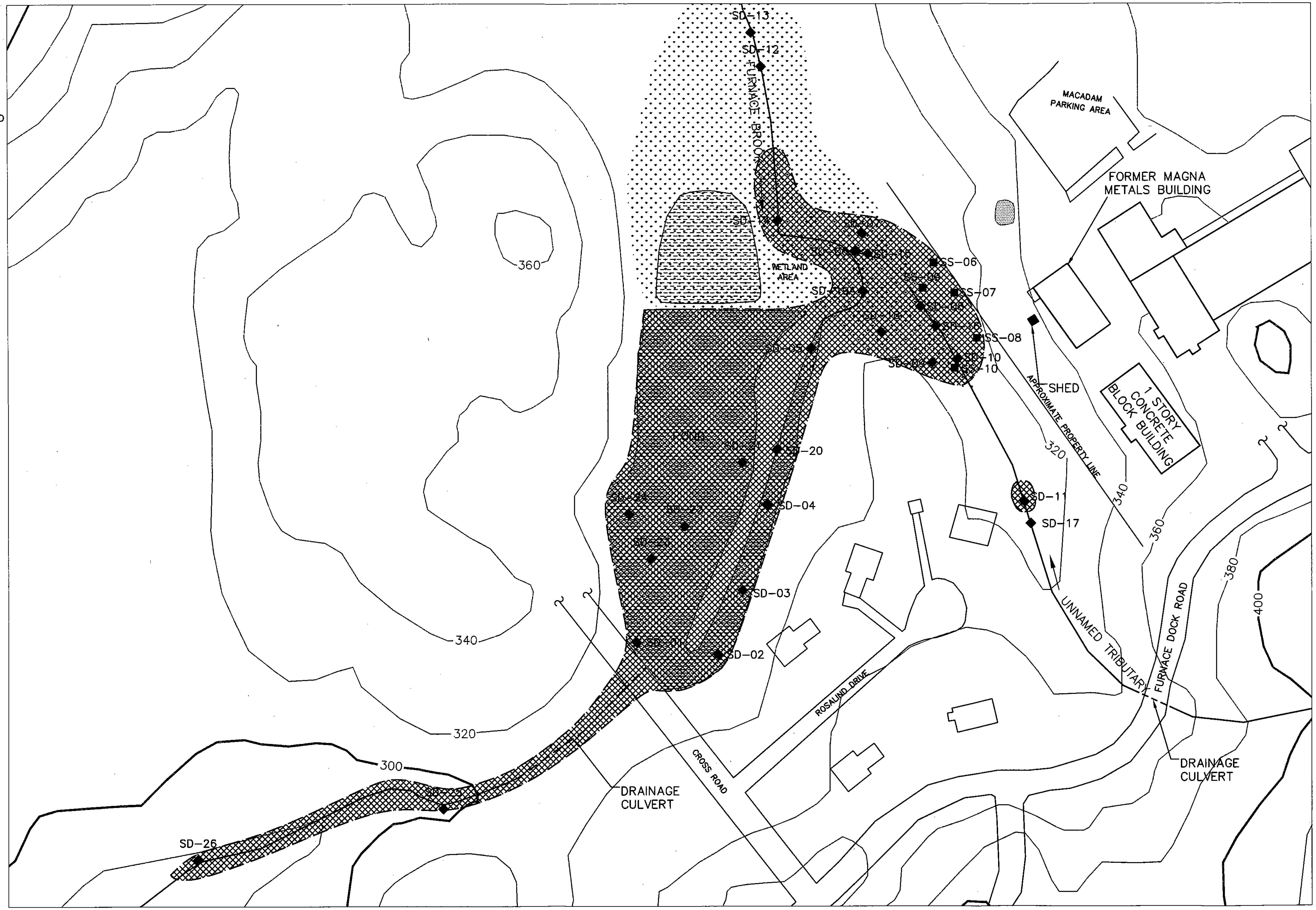

TETRA TECH EC, INC.

TITLE: Alternative SD-3C: Off-Site Removal of Metals – Impacted Sediments Above NYSDEC LELs
Magna Metals
Cortlandt, New York

DWN: LMC	DES.: EAG	PROJECT NO.: 106-1172
CHKD:	APPD:	FIGURE NO.: 4-4C
DATE: 12/03/09	REV.: 0	

N:\GIS\GISKEY\GISPROJ31\MAGNA METALS\FS FIGURES\FIGURE 4-4C SEDS ABOVE LELS 120309.DWG

BCLP04250

5.0 COMPARATIVE ANALYSIS

The following section compares the relative performance of each remedial alternative using the specific evaluation criteria presented in Section 4.1. Comparisons are presented in a qualitative manner, and identify substantive differences between the alternatives. As with the detailed evaluation, the following criteria are used for the comparative analysis.

- Compliance with SCGs;
- Overall Protection of Human Health and the Environment;
- Short-Term Impact and Effectiveness;
- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, and/or Volume;
- Implementability; and
- Cost

5.1 Comparative Analysis of Soil Alternatives

5.1.1 Compliance with SCGs

Alternatives S-3 would achieve chemical-specific Restricted Use SCGs and S-4 would achieve Unrestricted Use SCGs for COCs by removal of soil exhibiting concentrations in excess of NYSDEC SCOs from the Site. The value added benefit of alternatives S-3 and S-4 is that impacted groundwater is remediated during soil removal. Alternatives S-1 and S-2 do not remove contamination from the Site.

5.1.2 Overall Protection of Human Health and the Environment

Alternatives S-3 and S-4 are the most protective of health and the environment, since they remove material above NYSDEC SCOs from the Site and significantly reduce or eliminate exposure to COCs in soil. Alternative S-2 mitigates exposure, but does not provide any removal or treatment that significantly reduces migration of contaminants or expedites the cleanup of the Site to regulatory standards. Alternative S-1 is the least protective, since it does not remove or treat contaminants nor mitigate the potential for exposure.

5.1.3 Short-Term Impact and Effectiveness

Alternatives S-1 and S-2 would have the lowest short-term impact. There would be no potential risks to workers or the public during implementation of these alternatives, since no active remediation would be performed. Alternatives S-3 and S-4 would produce disturbance of site contaminants as a result of construction activities. Exposures to workers and the public would be minimal and would be mitigated through appropriate health and safety procedures and engineering controls, as necessary. Alternatives S-3 and S-4 would have higher short-term impacts since any excavated or removed materials would need to be transported through off-site areas for off-site disposal. These impacts would be minimized through proper construction and transportation procedures and engineering controls.

5.1.4 Long-Term Effectiveness and Permanence

Alternatives S-3 is effective at contaminant reduction and reducing potential future exposure. Source materials would be removed and hot spot contaminated soil in the subsurface would be removed. During soil removal, impacted groundwater would be remediated within the excavation areas and there would no longer be the potential for source material to impact groundwater in the future. Based on the known extent of COCs in excess of NYSDEC SCOs, Alternative S-3 achieves a similar reduction of COCs as Alternative S-4. Alternative S-2 is less effective, since all existing contamination, including sources of contamination, would remain on-site. Exposures would be mitigated through institutional controls. Long-term O&M and land use restrictions would be required to ensure the effectiveness of this alternative. Alternative S-1 would not be effective, since it would not reduce potential exposures. Long-term monitoring would be required.

5.1.5 Reduction of Mobility, Toxicity, and/ or Volume

Alternatives S-3 and S-4 offer significant reductions in mobility and volume of contaminated soil, since soil excavation occurs in a large area. Both S-3 and S-4 also remove impacted groundwater during remediation activities such as dewatering. Alternative S-3 offers the same reduction in mobility and almost the same volume as Alternative S-4. Excluding contingency soil removals, alternatives S-3 and S-4 would remove approximately 7,000 and 7,800 CY of soil, respectively. The reduction of contaminant mass associated with Alternative S-4 is less than 10 percent greater than the mass reduction associated with Alternative S-3. Alternatives S-2 and S-1 offer no reduction in mobility, toxicity, or volume since no active remediation would be performed.

5.1.6 Implementability

All of the alternatives evaluated are technically feasible. Alternative S-1 is the easiest to implement, since no remedial activities are employed in this alternative. Alternative S-2 is also easy to implement, involving only institutional controls. Alternatives S-3 and S-4 would be more difficult to implement, as they involve building demolition and subsurface soil removal and installation of shoring and/or bracing.

Services, equipment, and materials are available for all alternatives. Alternatives S-1 and S-2 require no materials and limited services. Alternatives S-3 and S-4 require building demolition and excavation services in addition to backfill materials. However, some on-site soil may be suitable for reuse to offset the quantity.

All of the alternatives evaluated are administratively feasible. Alternatives S-1 and S-2 would be the easiest to implement (short-term) since no remedial activity would be performed. The remaining alternatives all involve construction activities and associated administrative activities (*e.g.*, permitting, public participation and coordination, etc.). Alternatives S-3 and S-4 would have some additional coordination requirements for demolition and off-site transportation, which the other alternatives would not entail. Long-term institutional management (*e.g.*, monitoring, reporting, public coordination) would be associated with all of the alternatives except for S-4.

5.1.7 Cost

Alternative S-1 has no capital costs and no O&M costs. Alternative S-2 has the next lowest capital cost and minimal O&M costs for periodic reviews. Alternative S-3 has the second highest capital costs, and minimal O&M costs for reviews. Alternative S-4 has the highest capital costs and no O&M costs. Alternative S-3 will result in comparable level of exposure reduction as S-4, but at a lower cost. Overall, the ranking of the alternatives based on net present value from lowest to highest is: S-1, S-2, S-3, S-4.

5.2 Comparative Analysis of Groundwater Alternatives

5.2.1 Compliance with SCGs

Alternative GW-1 would not trigger action- or location- specific SCGs. Alternatives GW-2, GW-3, and GW-4 would be performed in accordance with action- and location-specific SCGs. Alternatives GW-1 and GW-2 may eventually achieve chemical-specific SCGs for VOCs over an extended period of time by natural processes. Implementation of Alternative S-3 or S-4 achieves SCGs within the alternative's excavation boundaries. Alternative GW-3 could potentially achieve SCGs without the implementation of active soil remedial activities.

5.2.2 Overall Protection of Human Health and the Environment

Alternative GW-1 is the least protective, as it is a No Action alternative. Alternative GW-2 provides monitoring, institutional controls, and a sub-slab vapor mitigation system. Alternative GW-2 also involves hydraulic modeling and the construction of an expanded monitoring well network following soil removal. Monitoring of contaminants in groundwater would be implemented and groundwater use restrictions would be maintained. Alternative GW-3 involves active treatment of contaminated groundwater and would be more effective than GW-2. Alternative GW-4 involves all the technical components of GW-2 and also provides some beneficial enhancement to restoration of groundwater.

5.2.3 Short-Term Impact and Effectiveness

Alternative GW-1 would have the lowest short-term impact. There would be no potential exposure to workers or the public during implementation of the alternative, since no on-site activities or construction would be performed. The short-term impact of Alternative GW-2 would be slightly greater, since on-site construction of monitoring wells and a sub slab vapor system will be required. The short-term impact of Alternative GW-3 would include more intrusive activities at the Site. Short-term impacts of GW-4 would be similar to GW-2.

5.2.4 Long-Term Effectiveness and Permanence

Alternatives GW-1, GW-2, GW-3, and GW-4 would all require an extended period of time for groundwater to reach acceptable levels. GW-1, GW-2, and GW-4 require the greatest amount of time and GW-3 would require less time. Monitoring would provide additional assurance that there aren't off-site exposures under Alternatives GW-2 and GW-4. Alternative GW-3, by itself, not in conjunction with a soil alternative, would achieve protection of health over a shorter time period because it involves actively treating the contamination in groundwater.

5.2.5 Reduction of Mobility, Toxicity, and/or Volume

Alternative GW-1 offers no reduction in mobility, toxicity, or volume, since no active remediation would be performed. Alternative GW-2 offers no reduction by itself. However, significant reduction can be achieved in GW-1, GW-2, and GW-4 by implementation of soil Alternatives S-3 or S-4. Monitoring will verify reduction of mobility, toxicity, and volume. Alternative GW-3 would provide reduction of contaminant mobility, toxicity, and/or volume via active treatment without implementation of soil alternatives S-3 or S-4.

5.2.6 Implementability

All of the alternatives evaluated are technically feasible. Alternative GW-1 is easiest to implement. Alternative GW-2 and GW-4 are somewhat more difficult to implement, requiring hydraulic modeling to determine locations of monitoring wells and confirmatory sampling, possibly over an extended time period. Alternative GW-3 would be the most difficult to implement because it involves active remediation.

Alternative GW-1 requires no services, equipment, or materials. Services, equipment and materials are readily available for Alternatives GW-2, GW-3, and GW-4. Alternatives GW-2 and GW-4 require consulting services for monitoring and data evaluation, construction services for monitoring network installation, and construction of a soil vapor system and O&M of the system, all of which are readily available. Alternative GW-4 also involves application of permanganate to the top of the bedrock surface in conjunction with soil alternatives S-3 or S-4. Alternative GW-3 would require consulting services and services for treatment implementation as well as O&M. Treatment services and equipment for this alternative are available.

5.2.7 Cost

Alternative GW-1 has no capital costs and no O&M costs. Alternatives GW-2 and GW-4 have higher capital and O&M costs for implementation of monitoring activities, installation of a sub slab vapor system, and subsequent O&M. Alternative GW-3 has the highest capital costs, but lower O&M costs due to the shorter timeframe to achieve the class GA standards (assuming that no soil remediation is performed). Sub slab depressurization will have O&M costs in GW-2, GW-3, and GW-4.

5.3 Comparative Analysis of Sediment Alternatives

5.3.1 Compliance with SCGs

Alternatives SD-3A, SD-3B, and SD-3C remove contaminated sediments from the Site to achieve cleanup objectives. Alternatives SD-1 and SD-2 do not remove contaminated materials from the Site.

5.3.2 Overall Protection of Human Health and the Environment

Alternative SD-3C is the most protective of health and the environment because it would remove contaminated materials to NYSDEC LELs. Alternative SD-3B would re-establish sediment conditions similar to background (pre-release). Alternative SD-3A provides protection of resources by removing contaminated materials to habitat assessment-based PRGs. Alternative SD-2 prevents human exposure through use restrictions, but does not provide any removal or containment that significantly reduces contaminant migration and/or ecological exposure. Alternative SD-1 is the least protective, since it does not remove or treat contaminants nor reduce the risk of exposure.

5.3.3 Short-Term Impact and Effectiveness

Alternatives SD-1 and SD-2 would have the lowest short-term impact. There would be no potential exposures to workers or the public during implementation of these alternatives, since no active remediation would be performed. Alternative SD-3A would have a high short-term impact because it involves excavation of contaminated sediment. Alternatives SD-3B and -3C would have the greatest short-term impacts, since they require extensive excavations of contaminated material. Alternative SD-3A, -3B, -3C could potentially increase risk of exposure to workers and the public. Off-site disposal is also required for Alternatives SD-3A, -3B, -3C. These impacts would be minimized through proper construction and transportation procedures and engineering controls.

5.3.4 Long-Term Effectiveness and Permanence

Alternatives SD-3B and -3C are the most effective at reducing potential exposures to health and the environment. Alternative SD-3A is effective at reducing habitat assessment-based risks to ecological resources. Alternative SD-2 is less effective, since existing contamination, including sources of contamination, would remain. Exposure would be minimized through institutional controls. However, this alternative would not be effective in minimizing ecological risks since ecological exposure would remain. Alternative SD-1 would not be effective, since it would not reduce potential health or ecological risks. Long-term monitoring would be required.

5.3.5 Reduction of Mobility, Toxicity, and/or Volume

Alternatives SD-3B and -3C offer the most significant reduction in mobility and volume of contaminated soil, since sediments with contaminated material exceeding the most stringent remedial goals or criteria would be removed. Alternative SD-3A offers a significant reduction in mobility and volume. Alternatives SD-1 and SD-2 offer no reduction in mobility, toxicity, or volume.

5.3.6 Implementability

All of the sediment alternatives evaluated are technically feasible. However, SD-3B and SD-3C are the most challenging. Alternative SD-1 is the easiest to implement, since no remedial activities are employed in this alternative. Alternative SD-2 may be easy to implement, involving only institutional controls, however, the sediments are off-site, on private property, which may make use restrictions difficult to implement. Alternatives SD-3A, -3B and -3C would be difficult to implement, as they involve removal of sediments in areas of surface water and wetlands. Control of water and stream flow would be required during implementation of SD-3A, -3B, and -3C. SD-3B and -3C are more difficult to implement because of the acreage involved, remoteness of some locations, and extensive mature wooded wetland system.

Services, equipment, and materials are available for all alternatives. Alternative SD-1 requires no materials or services. Alternative SD-2 requires limited services. Alternatives SD-3A, -3B and -3C require excavation, re-routing of streams and/or dewatering as well as restoration with appropriate material. The quantities of appropriate backfill are substantial; the quantity of backfill material under Alternatives SD-3B and -3C are the largest.

All of the alternatives evaluated are administratively feasible. Alternatives SD-1 and SD-2 would be the easiest to implement (short-term) since no or very limited activity would be performed. The remaining alternatives involve construction activities and associated administrative activities (*e.g.*, permitting, public participation and coordination, etc.). Alternative SD-3A, -3B, and -3C would have some additional coordination requirements for off-site transportation, which the other alternatives would not entail. Alternatives SD-3B and -3C may be very difficult to implement due to the property access issues, disturbances to third party property, and restoration requirements. Long-term institutional management (*e.g.*, monitoring, reporting, public coordination) would be associated with all of the alternatives except SD-1. In addition, off-site private property access will be required to implement Alternatives SD-3A, -3B and -3C.

5.3.7 Cost

Alternative SD-1 has no capital costs and no O&M costs. Alternative SD-2 has the next lowest capital and O&M costs for implementation of institutional controls. Removal alternatives have the highest capital and O&M costs (ranging in cost based on standards and criteria). Overall, the ranking of the alternatives based on net present value (capital and O&M) from lowest to highest is: SD-1, SD-2, SD-3A, SD-3B, and SD-3C.

6.0 PROPOSED REMEDIAL ALTERNATIVE

This section presents the proposed alternative for each media based on the evaluations presented in the previous sections. As noted in these evaluations, there are inter-relationships between the media-specific alternatives. Therefore, the media-specific alternative proposals are followed by a description of the overall proposed plan for site remediation that describes these inter-relationships and how the proposed alternatives result in the most effective overall remediation plan for the Site.

6.1 Media-specific Alternative Proposal

The following sections describe the proposed remedial alternatives for each media.

6.1.1 Soil Remedial Alternative

Based on the evaluation of soil alternatives, S-3 (Removal of COCs in Soil Exhibiting Concentrations in Excess of NYSDEC Restricted Use SCOs and Building Demolition) is proposed.

Removal of the sources of COCs in soil in excess of NYSDEC Restricted Use SCOs would be protective of human health and the environment and would provide protection against further migration and transfer into other media. As a result of the soil removal, the impacted groundwater will also be mitigated. Removed soils will be replaced with clean fill or site backfill (if below SCOs).

6.1.2 Groundwater Remedial Alternative

The proposed alternative for groundwater is Alternative GW-4 (Limited Permanganate Application, Groundwater Monitoring, and Sub Slab Vapor Mitigation). Environmental easements will be implemented to protect against potable water wells being drilled and installed on-site. Based on data collected during the RI, there are no potable groundwater wells on-site or in the near vicinity that pose an exposure. Implementation of S-3 will immediately mitigate the impacted contaminated groundwater and bring groundwater into compliance with Class GA standards within the excavation area. In conjunction with S-3, GW-4 will also include a one-time permanganate application to the top of the bedrock surface which will be beneficial to enhancing restoration of groundwater.

Installation of a sub slab depressurization system to address elevated VOC concentrations is also included in this alternative, to mitigate the potential for sub slab vapor intrusion.

6.1.3 Sediment Remedial Alternative

Based on the evaluation of sediment alternatives, SD-3A (Removal of Metals-Impacted Sediments above PRGs is the proposed remedy.

Removal of impacted sediments to the habitat assessment-based PRGs will provide protection against further sediment system impacts.

6.2 Proposed Plan for Site Remediation

The proposed plan for the site remediation incorporates Alternatives S-3, GW-4, and SD-3A. Implementation of Alternative S-3 will remove COCs to meet chemical-specific SCGs. An added benefit of S-3 is that the impacted groundwater is also remediated in excavation areas via removal of overburden soils. Because the most significant groundwater impacted areas are addressed during S-3, the recommendation of Alternative GW-4 can be made and any potential future risk of exposure to groundwater can be controlled by institutional controls that prevent the installation of wells or usage of groundwater for potable supply at the Site. Furthermore, permanganate would be added to the bedrock surface, which will enhance restoration of groundwater. Groundwater would be monitored by a monitoring well system subject to periodic reviews. Operation of the sub slab vapor mitigation system will also provide positive benefit. Implementation of Alternative SD-3A will remove contaminated sediments which will mitigate potential current and future risks based upon the RI Habitat Assessment.

The overall net present value based on a 30-year period of performance for implementation of the selected remedy (i.e., S-3, GW-4, and SD-3A) is $6,621,000.

7.0 REFERENCES

AKRF. February 2007 Soil Vapor Work Plan.

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APPENDIX A

REMEDIAL ALTERNATIVE COST ESTIMATES

TABLE A-1

ALTERNATIVE COST ESTIMATE SUMMARY

Alternative	Capital	O&M (Annual)	Annual O&M NPV	Reviews NPV	Total O&M NPV	Total NPV
Soil Alternatives						
S-1 (No Action)	0	0	0	0	0	0
S-2 (Limited Action)	39,000	0	0	56,000	56,000	95,000
S-3 (Removal of COCs in Soil Above NYSDEC Restricted Use SCOs and Building Demolition)	3,696,000	0	0	56,000	56,000	3,752,000
S-4 (Removal of COCs in Soil Above NYSDEC Unrestricted Use SCOs and Building Demolition)	3,907,000	0	0	0	0	3,907,000
Groundwater Alternatives						
GW-1 (No Action)	0	0	0	0	0	0
GW-2 (Groundwater Monitoring and Sub Slab Vapor Mitigation)	250,000	40,000	621,000	56,000	677,000	927,000
GW-3 (*In Situ* Treatment and Sub Slab Vapor Mitigation)	1,490,000	40,000	621,000	56,000	677,000	2,167,000
GW-4 (Limited Permanganate Addition, Groundwater Monitoring, Sub Slab Vapor Mitigation)	377,000	40,000	621,000	56,000	677,000	1,054,000
Sediment Alternatives						
SD-1 (No Action)	0	0	0	0	0	0
SD-2 (Limited Action)	39,000	0	0	56,000	56,000	95,000
SD-3a (Removal > Habitat Based PRGs)	1,427,000	22,000	332,000	56,000	388,000	1,815,000
SD-3b (Removal > Background)	5,079,000	22,000	332,000	56,000	388,000	5,467,000
SD-3c (Removal > LELs)	5,048,000	22,000	332,000	56,000	388,000	5,436,000
Preferred Remedy						
S-3, GW-4, SD-3A	5,500,000	62,000	953,000	168,000	1,121,000	6,621,000

TABLE A-2
ALTERNATIVE S-2 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
				Subtotal	$ 30,000
				Contingency (20%)	$ 6,000
				Engineering (N/A)	$ -
				Legal and Administrative (10%)	$ 3,000
				Grand Total	**$ 39,000**

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TABLE A-3
ALTERNATIVE S-3 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	30,000	30,000
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
	SITE PREPARATION				
	Clearing and grading	2000	SY	1.00	2,000
	SUPPORT FACILITIES				
	Office trailers	1	LS	7,500	7,500
	Decon trailer	1	LS	5,250	5,250
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	1000	LF	10	10,000
	BUILDING DEMOLITION				
	Demolition of Former Magna Metals Building	1	LS	200,000	200,000
	EXCAVATION				
	Leach pits and septic tank removal	13	EA	2,500	32,500
	Monitoring well removal	6	EA	500	3,000
	Soil Excavation (above water table)	5580	CY	20	111,600
	Soil Excavation (below water table)	1400	CY	40	56,000
	Contingency Soil Excavation (above water table)	2600	CY	20	52,000
	Contingency Soil Excavation (below water table)	1300	CY	40	52,000
	Material Handling	10880	CY	4	43,520
	Sheet Piling	1000	LF	60	60,000
	POST EXCAVATION SAMPLING				
	Post-excavation sampling	60	EA	450	27,000
	OFF-SITE TREATMENT & DISPOSAL				
	Tanks/Piping/Debris	39	Ton	75	2,925
	Non-hazardous soil	16320	Ton	100	1,632,000
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	285,000	Gal	0.20	57,000
	SITE RESTORATION/CAP				
	Clean fill	10480	CY	25	262,000
	Top soil	400	CY	30	12,000
	Restoration of Wetlands	0	Acres	8,000	-
	Seeding	0.5	Acres	1,875	938
	MISCELLANEOUS				
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	6	MO	7,500	45,000

Subtotal	$	2,737,983
Contingency (20%)	$	547,600
Engineering (10%)	$	273,800
Legal and Administrative (5%)	$	136,900
Grand Total	**$**	**3,696,283**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Six wells within the excavation area to be removed
3. Silt fence installed around excavation area for erosion and sediment control
4. Leach pits/septic tank removal assumes 13 total pits/tanks removed (2007 RI Report)
5. Depth of water table: 10 feet bgs
6. Depth of subsurface soil excavations: 12.5 feet
7. Sheet piling needed for all subsurface soil excavation areas
8. Post excavation sampling - 1 sample per 30 LF sidewall, 1 sample per 900 sf excavation bottom
9. Tanks/piping/debris tonnage based on estimated volume of 1.5 cy per tank/pit (including piping), 2.0 tons/cy unit weight
10. All soil non-hazardous for disposal purposes
11. Unit weight of excavated soil: 1.5 tons/cy
12. Top 6 inches restored with topsoil/seeding for all areas
13. Wetland restoration area less than 0.1 acres, assumed no wetland restoration necessary
14. Soil excavation below building contingent on verification of contamination
15. Contingency soil excavations beneath building upon verification of visual contamination
16. Demolition cost includes abatement

TABLE A-4
ALTERNATIVE S-4 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)		Estimated Cost
	MOBILIZATION/DEMOBILIZATION					
	Mobilization	1	LS	30,000		30,000
	SITE PREPARATION					
	Clearing and grading	2000	SY	1.00		2,000
	SUPPORT FACILITIES					
	Office trailers	1	LS	7,500		7,500
	Decon trailer	1	LS	5,250		5,250
	EROSION & SEDIMENT CONTROL					
	Silt Fence & Installation	1000	LF	10		10,000
	BUILDING DEMOLITION					
	Demolition of Former Magna Metals Building	1	LS	200,000		200,000
	EXCAVATION					
	Leach pits and septic tank removal	13	EA	2,500		32,500
	Monitoring well removal	6	EA	500		3,000
	Soil Excavation (above water table)	5,580	CY	20		111,600
	Soil Excavation (below water table)	2,230	CY	40		89,200
	Contingency Soil Excavation (above water table)	2600	CY	20		52,000
	Contingency Soil Excavation (below water table)	1300	CY	40		52,000
	Material Handling	11,710	CY	4		46,840
	Sheet Piling	1000	LF	60		60,000
	POST EXCAVATION SAMPLING					
	Post-excavation sampling	60	EA	450		27,000
	OFF-SITE TREATMENT & DISPOSAL					
	Tanks/Piping/Debris	39	Ton	75		2,925
	Non-hazardous soil	17565	Ton	100		1,756,500
	Hazardous soil	0	Ton	280		-
	Dewatering water treatment	300,000	Gal	0.20		60,000
	SITE RESTORATION					
	Clean fill	11310	CY	25		282,750
	Top soil	400	CY	30		12,000
	Restoration of Wetlands	0	Acres	8,000		-
	Seeding	0.5	Acres	1,875		938
	MISCELLANEOUS					
	Misc. Disposal	1	LS	5,000		5,000
	Health and Safety Oversight	6	MO	7,500		45,000
				Subtotal	$	2,894,003
				Contingency (20%)	$	578,800
				Engineering (10%)	$	289,400
				Legal and Administrative (5%)	$	144,700
				Grand Total	**$**	**3,906,903**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Six wells within the excavation area to be removed.
3. Silt fence installed around excavation area for erosion and sediment control
4. Leach pits/septic tank removal assumes 13 total pits/tanks removed (2007 RI Report)
5. Depth of water table: 10 feet bgs
6. Depth of subsurface soil excavations: 14 feet
7. Sheet piling needed for all subsurface soil excavation areas
8. Post excavation sampling - 1 sample per 30 LF sidewall, 1 sample per 900 sf excavation bottom
9. Tanks/piping/debris tonnage based on estimated volume of 1.5 cy per tank/pit (including piping), 2.0 tons/cy unit weight
10. All soil non-hazardous for disposal purposes
11. Unit weight of excavated soil: 1.5 tons/cy
12. Top 6 inches restored with topsoil/seeding for all areas
13. Wetland restoration area less than 0.1 acres, assumed no wetland restoration necessary
14. Soil excavation below building contingent on verification of contamination
15. Contingency soil excavations beneath building upon verification of visual contamination
16. Demolition cost includes abatement.

TABLE A-5
ALTERNATIVE GW-2 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)		Estimated Cost
	MOBILIZATION/DEMOBILIZATION					
	Mobilization	1	LS	30,000		30,000
	Decontamination Pad		LS	750		750
	ADMINISTRATIVE ACTIONS					
	Institutional Controls	1	LS	10,000		10,000
	Health and Safety Plan	1	LS	10,000		10,000
	Site Management Plan	1	LS	10,000		10,000
	GW MONITORING					
	System Design	1	EA	7,500		7,500
	GW MONITORING WELL INSTALLATION					
	Well installation	3	EA	1,000		3,000
	SUB-SLAB DEPRESSURIZATION					
	Sub-Slab Depressurization System	1	LS	125,000		125,000
	CONSTRUCTION					
	Health and safety	1	LS	4,000		4,000
				Subtotal	$	200,250
				Contingency (20%)	$	40,100
				Engineering (N/A)	$	-
				Legal and Administrative (5%)	$	10,000
				Grand Total	**$**	**250,350**

Notes and Assumptions:
1. Health and safety costs are estimated for H&S oversight during approximately a 1 week construction period
2. Three new overburden monitoring wells added to monitoring network (may change based on system design)

TABLE A-6
ALTERNATIVE GW-3 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	30,000	30,000
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
	SUPPORT FACILITIES				
	Decontamination Area	1	LS	4,000	4,000
	CHEMICAL OXIDATION				
	Bench/Pilot study	1	EA	25,000	25,000
	Injection	750	EA	1,000	750,000
	SUB-SLAB DEPRESSURIZATION				
	Sub-Slab Depressurization System	1	LS	125,000	125,000
	MISCELLANEOUS				
	Misc. disposal	1	LS	4,000	5,000
	Health and safety oversight	18	MO	7,500	135,000
				Subtotal	$ 1,104,000
				Contingency (20%)	$ 220,800
				Engineering (10%)	$ 110,400
				Legal and Administrative (5%)	$ 55,200
				Grand Total	**$ 1,490,400**

Assumptions:
1. *In Situ* Chemical Oxidation used as treatment process.
2. Unit cost of injection based on ISOTEC quote and includes cost of chemicals

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TABLE A-7
ALTERNATIVE GW-4 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	30,000	30,000
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
	BEDROCK PERMANGANATE TREATMENT				
	Permanganate Addition	1	LS	70,000	70,000
	SUB-SLAB DEPRESSURIZATION				
	Sub-Slab Depressurization System	1	LS	125,000	125,000
	MISCELLANEOUS				
	Misc. disposal	1	LS	4,000	5,000
				Subtotal	$ 260,000
				Contingency (20%)	$ 52,000
				Engineering (20%)	$ 52,000
				Legal and Administrative (5%)	$ 13,000
				Grand Total	**$ 377,000**

Note:
1. This alternative can only be implemented in conjunction with Soil Alternatives S-3 or S-4.

TABLE A-8
ALTERNATIVE SD-2 CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
				Subtotal	$ 30,000
				Contingency (20%)	$ 6,000
				Engineering (N/A)	$ -
				Legal and Administrative (10%)	$ 3,000
				Grand Total	**$ 39,000**

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TABLE A-9
ALTERNATIVE SD-3a CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	30,000	30,000
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
	SITE PREPARATION				
	Clearing and grading	5000	SY	1	5,000
	SUPPORT FACILITIES				
	Office trailers	1	LS	7,500	7,500
	Decon trailer	1	LS	5,250	5,250
	EXCAVATION				
	Sediment and Surface Soil Excavation	3840	CY	20	76,800
	Material Handling	3840	CY	4	15,360
	POST EXCAVATION SAMPLING				
	Post-excavation sampling	58	EA	450	26,100
	OFF-SITE TREATMEANT & DISOSAL				
	Non-hazardous soil	5760	Ton	100	576,000
	Hazardous soil	0	Ton	280	-
	SITE RESTORATION				
	Clean fill	0	CY	25	-
	Top soil (suitable sediment)	3840	CY	40	153,600
	Restoration of Wetlands	1.2	Acres	8,000	9,600
	Seeding	0	Acres	1,875	-
	MISCELLANEOUS				
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	6	MO	7,500	45,000
				Subtotal	$ 983,960
				Contingency (20%)	$ 196,800
				Engineering (20%)	$ 196,800
				Legal and Administrative (5%)	$ 49,200
				Grand Total	**$ 1,426,760**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Top 2 feet of sediment removed, streams/tributaries will be diverted with pipes.
3. Removed sediment replaced with sediment-like material
4. Post excavation sampling - 1 sample per 900 sf excavation bottom
5. All sediments non-hazardous for disposal purposes
6. Unit weight of excavated sediment: 1.5 tons/cy
7. Entire area of removed sediments are wetlands

TABLE A-10
ALTERNATIVE SD-3b CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	30,000	30,000
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
	SITE PREPARATION				
	Clearing and grading	24000	SY	1	24,000
	SUPPORT FACILITIES				
	Office trailers	1	LS	7,500	7,500
	Decon trailer	1	LS	5,250	5,250
	EXCAVATION				
	Sediment and Surface Soil Excavation	16000	CY	20	320,000
	Material Handling	16000	CY	4	64,000
	POST EXCAVATION SAMPLING				
	Post-excavation sampling	240	EA	450	108,000
	OFF-SITE TREATMEANT & DISOSAL				
	Non-hazardous soil	24000	Ton	100	2,400,000
	Hazardous soil	0	Ton	280	-
	SITE RESTORATION				
	Clean fill	0	CY	25	-
	Top soil (suitable sediment)	16000	CY	40	640,000
	Restoration of Wetlands	5.0	Acres	8,000	40,000
	Seeding	0	Acres	1,875	-
	MISCELLANEOUS				
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	12	MO	7,500	90,000

Subtotal	$	3,762,500
Contingency (20%)	$	752,500
Engineering (10%)	$	376,300
Legal and Administrative (5%)	$	188,100
Grand Total	**$**	**5,079,400**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Top 2 feet of sediment removed, streams/tributaries will be diverted with pipes.
3. Removed sediment replaced with sediment-like material
4. Post excavation sampling - 1 sample per 900 sf excavation bottom
5. All sediments non-hazardous for disposal purposes
6. Unit weight of excavated sediment: 1.5 tons/cy
7. Entire area of removed sediments are wetlands

TABLE A-11
ALTERNATIVE SD-3c CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	30,000	30,000
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	10,000	10,000
	Site Management Plan	1	LS	10,000	10,000
	SITE PREPARATION				
	Clearing and grading	23800	SY	1	23,800
	SUPPORT FACILITIES				
	Office trailers	1	LS	7,500	7,500
	Decon trailer	1	LS	5,250	5,250
	EXCAVATION				
	Sediment and Surface Soil Excavation	15900	CY	20	318,000
	Material Handling	15900	CY	4	63,600
	POST EXCAVATION SAMPLING				
	Post-excavation sampling	238	EA	450	107,100
	OFF-SITE TREATMEANT & DISOSAL				
	Non-hazardous soil	23850	Ton	100	2,385,000
	Hazardous soil	0	Ton	280	-
	SITE RESTORATION				
	Clean fill	0	CY	25	-
	Top soil (suitable sediment)	15900	CY	40	636,000
	Restoration of Wetlands	4.9	Acres	8,000	39,440
	Seeding	0	Acres	1,875	-
	MISCELLANEOUS				
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	12	MO	7,500	90,000

Subtotal	$	3,739,440
Contingency (20%)	$	747,900
Engineering (10%)	$	373,900
Legal and Administrative (5%)	$	187,000
Grand Total	**$**	**5,048,240**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Top 2 feet of sediment removed, streams/tributaries will be diverted with pipes.
3. Removed sediment replaced with sediment-like material
4. Post excavation sampling - 1 sample per 900 sf excavation bottom
5. All sediments non-hazardous for disposal purposes
6. Unit weight of excavated sediment: 1.5 tons/cy
7. Entire area of removed sediments are wetlands

TABLE A-12
ALTERNATIVE S-2 O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	8	% of Capital	-	-
	Contingency	10	% of O&M	-	-
	5-year reviews	6	EA	20,000	N/A
				Annual O&M (excl. 5-yr reviews)	$ -
				Project duration (years)	30
				Interest rate	5%
				NPV Annual O&M	$ -
				NPV Reviews	$ 55,600
				Total NPV O&M	**$ 55,600**

TABLE A-13
ALTERNATIVE S-3 O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	8	% of Capital	-	-
	Contingency	10	% of O&M	-	-
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ -
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ -
NPV Reviews	$ 55,600
Total NPV O&M	**$ 55,600**

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TABLE A-14
ALTERNATIVE GW-2 O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	Operation, Maintenance & Monitoring	15	% of Capital	125,000	18,800
	MONITORING				
	Groundwater sampling (labor)	20	hr/yr	80	1,600
	Groundwater analysis	10	EA	1,000	10,000
	Data Analysis/Reporting	1	LS	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 40,400
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 621,000
NPV Reviews	$ 55,600
Total NPV O&M	**$ 676,600**

Notes and Assumptions:
1. Maintenance cost is based on 15% of capital cost for only those components requiring long-term maintenance (i.e., SSDS)
2. 10 wells would be monitored biannually for a period of 5 years
3. Two 10-hr days to complete monitoring (biannually) of 10 wells

TABLE A-15
ALTERNATIVE GW-3 O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	Operation, Maintenance & Monitoring	15	% of Capital	125,000	18,800
	MONITORING				
	Groundwater sampling (labor)	20	hr/yr	80	1,600
	Groundwater analysis	10	EA	1,000	10,000
	Data Analysis/Reporting	1	LS	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 40,400
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 621,000
NPV Reviews	$ 55,600
Total NPV O&M	**$ 676,600**

Notes and Assumptions:
1. Maintenance cost is based on 15% of capital cost for only those components requiring long-term maintenance (i.e., SSDS)
2. Monitoring and sampling of groundwater would be performed until clean-up levels are achieved- this is assumed to be long-term for cost estimate purposes
3. 10 wells would be monitored biannually for a period of 5 years
4. Two 10-hr days to complete monitoring (biannually) of 10 wells

TABLE A-16
ALTERNATIVE GW-4 O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	Operation, Maintenance & Monitoring	15	% of Capital	125,000	18,800
	MONITORING				
	Groundwater sampling (labor)	20	hr/yr	80	1,600
	Groundwater analysis	10	EA	1,000	10,000
	Data Analysis/Reporting	1	LS	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 40,400
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 621,000
NPV Reviews	$ 55,600
Total NPV O&M	**$ 676,600**

Notes and Assumptions:

1. Maintenance cost is based on 15% of capital cost for only those components requiring long-term maintenance (i.e., SSDS)
2. Monitoring and sampling of groundwater would be performed until clean-up levels are achieved- this is assumed to be long-term for cost estimate purposes
3. 10 wells would be monitored biannually for a period of 5 years
4. Two 10-hr days to complete monitoring (biannually) of 10 wells

TABLE A-17
ALTERNATIVE SD2 O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	8	% of Capital	-	-
	Contingency	10	% of O&M	-	-
	5-year reviews	6	EA	20,000	N/A
			Annual O&M (excl. 5-yr reviews)		$ -
			Project duration (years)		30
			Interest rate		5%
			NPV Annual O&M		$ -
			NPV Reviews		$ 55,600
			Total NPV O&M		**$ 55,600**

TABLE A-18
ALTERNATIVE SD-3a O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	SURFACE WATER SAMPLING				
	Surface water sampling (labor)	20	hr/yr	80	1,600
	Surface water analysis	10	EA	1,000	10,000
	Data Analysis/Reporting	1	LS	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 21,600
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 332,000
NPV Reviews	$ 55,600
Total NPV O&M	**$ 387,600**

Notes and Assumptions:
1. Surface water would be monitored biannually for a period of 5 years
2. Two 10-hr days to complete monitoring (biannually)

TABLE A-19
ALTERNATIVE SD-3b O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	SURFACE WATER SAMPLING				
	Surface water sampling (labor)	20	hr/yr	80	1,600
	Surface water analysis	10	EA	1,000	10,000
	Data Analysis/Reporting	1	LS	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 21,600
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 332,000
NPV Reviews	$ 55,600
Total NPV O&M	**$ 387,600**

Notes and Assumptions:
1. Surface water would be monitored biannually for a period of 5 years
2. Two 10-hr days to complete monitoring (biannually)

TABLE A-20
ALTERNATIVE SD-3c O&M COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	SURFACE WATER SAMPLING				
	Surface water sampling (labor)	20	hr/yr	80	1,600
	Surface water analysis	10	EA	1,000	10,000
	Data Analysis/Reporting	1	LS	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 21,600
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 332,000
NPV Reviews	$ 55,600
Total NPV O&M	**$ 387,600**

Assumptions:

APPENDIX B

MASS REDUCTION ANALYSIS

Table B-1
Calculation of Mass Removal
Former Magna Metals Site
Cortlandt, New York

Location	MW-02	MW-02	MW-02	MW-03	MW-04	MW-04	SB-1	SB-2	SB-3	SB-4
Sample ID	MW-02	Duplicate	MW-02	MW-03	MW-04	MW-04	SB-1	SB-2	SB-3	SB-4
Sample Date	11/18/97	of MW-02	11/18/97	11/17/97	11/18/97	11/18/97	12/10/1996	12/10/1996	12/10/1996	12/10/1996
Sample Depth (feet bgs)	6-8	6-8	12-14	6-8	6-8	12-14	4-6	8-9.5	8-9.5	6.5-8.5
Copper	45.9	42.8	114	695	23.2	19.4	40.4	52.2	83.8	249
Nickel	10.4	10.5	39	28.4	11.3	7.4	46.9	108	62.5	84.2

Location	SB-5	SB-6	SB-7	SB-7	SS-01	SS-01	SS-02	SS-03	SS-11	SS-12
Sample ID	SB-5	SB-6	SB-7	Duplicate of	SS-01	Duplicate of	SS-02	SS-03	MM-SS11-072903	MM-SS12-072903
Sample Date	12/10/1996	12/11/1996	12/11/1996	SB-7	04/11/97	SS-01	04/11/97	04/11/97	7/29/2003	7/29/2003
Sample Depth (feet bgs)	4.5-6.5	7-10	3.5-5.5	3.5-5.5	0-0.17	0-0.17	0-0.17	0-0.17	0-0.17	0-0.17
Copper	369	1309	87.2	71.2	177	51.7	39	18	30.2	136
Nickel	38.9	93.5	15.5	11.9	15	13.9	11.4	10.2	11.6	11.1

	Average	S-3	S-3	S-4	S-4
	Concentration	Excavation	Removal	Excavation	Removal
	(mg/kg)	(tons)	(lbs of constituent)	(tons)	(lbs of constituent)
Copper	182.7	16320	5963.328	17565	6418.251
Nickel	32.08	16320	1047.0912	17565	1126.9704